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THE UNIVERSITY OF ALBERTA

The Efficacy of Relaxation and Imagery in Chronic Low Back Pain Management

by

Brian Joseph Boon

(C)

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND RESEARCH

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE

OF Doctor of Philosophy

IN

Counselling Psychology

Department of Educational Psychology

EDMONTON, ALBERTA

Fall, 1988

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THE UNIVERSITY OF ALBERTA

FACULTY OF GRADUATE STUDIES AND RESEARCH

The undersigned certify that they have read, and recommend to the Faculty of Graduate Studies and Research, for acceptance, a thesis entitled The Efficacy of Relaxation and Imagery in Chronic Low Back Pain (CLBP) Management submitted by Brian Joseph Boon in partial fulfilment of the requirements for the degree of Doctor of Philosophy in Counselling Psychology.

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External Examiner

Date..June.9/88.....

DEDICATION

To my wife, Lorna Kathryn Boon

Abstract

Chronic low back pain (CLBP) presents as a phenomenon of considerable personal, social and economic cost. This study examines the effectiveness of variations in the psychological treatment intervention of CLBP. All research subjects (N = 84) were male compensation CLBP patients attending a rehabilitation centre outpatient day programme. The specific purpose of the study was to compare the active agents of intervention, that is progressive muscle relaxation (R), imagery (I), and relaxation + imagery (M) to one another and to a psychoeducational (P) comparison group. All three active treatment groups received the same relevant psychological CLBP literature as comprised the entire programme of the psychoeducational group. All subjects were randomly assigned to groups and treatments to groups. The dependent measures of interest were depression (Beck Depression Inventory), state-anxiety (State-Trait Anxiety Inventory) and subjective pain (modified visual-analogue scale). An orthogonal contrast design was utilized to address the comparisons of interest. Only one contrast (active treatments versus the psychoeducational comparison group) was found to be significant on all dependent measures with the exception of the depression measure. An exploratory reanalysis of the outcome data (ANOVA) was conducted to readdress initial research interests with respect to the active treatment differences. A cautioned interpretation favoured relaxation as the most dominant component in terms

of subjective pain and state-anxiety reduction.

A MANOVA conducted on the subjective course evaluation questionnaire found significant main effects for relaxation and imagery but not a significant interaction effect; the univariate tests of significance determined imagery to be viewed as more effective than relaxation or relaxation x imagery on most items. A MANOVA with specific contrasts on a two month follow-up questionnaire found significant differences between the relaxation + imagery (M) group to the relaxation (R) and imagery (I) groups with respect to the overall perceived improvement in general well-being. The implications of these findings and those of the contrast design and subsequent questionnaire analyses are discussed.

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Foremost I wish to acknowledge my wife Lorna, who helped me in coping with the demands of this project. She

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I. Introduction

The back is a complex structure composed of bone, nerve, muscles, and fat. However, based on the prevalency of back injury, it would appear that the complex architecture of the back, its design and construction, is not well suited to meet the functional demands placed upon it. In the evolution of the human species, the back has miserably failed to adapt to its newly acquired upright position.

Nearly everyone in their lifetime has suffered from the consequences of a sore back. Statistics on the back pain syndrome indicate near epidemic numbers. Back injuries and/or disabilities rate as the second most common cause of disability in the adult population in the United States and Canada, and on any given day 11 million people in these two countries are suffering from back pain (Hall, 1980). The back will cause difficulty for 8 out of every 10 Canadians at some time in their lives (Scalon, 1986). More than 200,000 North Americans a year undergo back surgery (Imrie, 1983).

Back pain inflicts monstrous social and economic costs. Time lost from work for the treatment of back pain costs North American industry upwards of 15 billion dollars per year (Imrie, 1983). In 1984, back problems accounted for approximately one-quarter of all compensation claims in Canada with Ontario's Workers' Compensation Board awarding $399 million for work-related back injury (Scalon, 1986). In Alberta in 1985, back injuries accounted for 22.7 percent of

new Workers' Compensation claims (Workers' Compensation Board, 1985). The number of compensation days paid for low back pain from January to October, 1986, were 158,530 days, resulting in an expenditure for that specific injury of $9,467,556.32 (Workers' Compensation Board, 1986). The economic costs of back injury are staggering indeed.

The lower back, or lumbar region, is implicated in most back injuries. At the Workers' Compensation Board Rehabilitation Centre in Edmonton, Alberta, back injury cases represent 51.9 percent of the patient population. Approximately 49 percent of the total patient population has a lower back problem. The lower back is vulnerable to injury because that section of the spine is more mobile, thereby must withstand the forces exerted upon it due to movement or lifting. For example, a mother who leans forward to pick up her small child can exert up to a half-ton of force on her lower back (Finneson, 1974). If a six-foot, 200 pound man simply bends forward from the waist, he exerts more than 900 pounds of pressure upon his fifth lumbar intervertebral disc (Rowe, 1983).

Low back pain not only causes distress for the sufferer, it also poses as a problem and challenge to the medical profession. From a treatment perspective low back pain is difficult to diagnose and the results are not typically satisfactory (Brown, Nemiah, Barr, & Barry, 1954; Flor & Turk, 1984; Levine, 1971; Sternbach & Rusk, 1973). Surgery is required for about 20 percent of the cases

(Crasilneck, 1979), and only about 60 percent of that population obtain total relief of pain (Rothman, Marvel, & Booth, 1977, cited in Crasilneck, 1979).

In instances of acute back pain (a pain duration of two months or less) usually history can determine causation and the site of pain can be located, making treatment straight forward. Acute back pain is a self-limiting condition that often disappears without medical consultation (Flor & Turk, 1984). Estimates suggest that 90 percent of acute back syndromes improve within a 2-month period (McKenzie, 1981). However, it is often the case that these patients relapse into a reoccurrence of back pain that is more severe and significantly longer lasting (Flor & Turk, 1984). The term chronic back pain (CBP) refers to the persistence of pain in absence of clinical evidence, inspite of various investigative efforts. At this point the reader is instructed that the terms chronic back pain (CBP) and chronic low back pain (CLBP) will be used interchangeably and for the purpose of this discussion should be considered equivalent. In CBP, the assumed origin is not a specific disease process, but rather thought to be degenerative, inflammatory, or muscular in origin. CBP is a syndrome which has lasted for six months, and often the pain becomes more than a symptom but rather a disorder in itself.

Despite the magnitude of chronic back pain and the abundance of medical literature on this topic, surprisingly little is known of the causes, and therefore effective

treatment. Although a review of medical approaches to the study and treatment of CBP is beyond the scope of the author's present purpose, a comment on this approach is warranted. Flor and Turk (1984) reviewed the somatic models and interventions for CBP. They concluded that attempts to delineate possible causes of CBP amount to little more than speculation based on limited empirical evidence. Their review demonstrated that neither degenerative, nor structural, nor muscular, nor occupational factors could be directly linked to low back pain. Although they readily admit these factors may contribute to the back pain syndrome, these factors alone are not sufficient causes for most back pain. Nachemson (1979) cogently summarized the situation by noting that after 25 years of clinical study in the back pain field that for the majority of patients, the true cause of back pain is unknown which realizes only tenuous, symptomatic medical treatment. Hence, the number of medical treatment approaches offered are based on less than sound pathophysiological assumptions on back pain.

The evaluation and treatment of those who suffer CBP is of major concern to a variety of health professionals. It is when physical/medical therapies fail to relieve pain symptoms, and when pain is either not proportional to a possible physical pathology or the physical etiology cannot be determined, that psychological services are retained. The medical profession should be applauded as previously disregarded psychosocial antecedents and consequences of CBP

are now being recognized with organic factors as possible determinants of CBP.

Typically, the chronic back pain patient has encountered a myriad of unfulfilled treatment expectations. As the lack of effectiveness of traditional medical approaches becomes realistically apparent to the patient, combined with a persistent pain problem, psychological factors begin to play an important role. These psychological factors that interact in the chronic back pain syndrome are either initiated or exacerbated by the initial injury. As well, psychological factors can become independent of continuing physical insult or damage to the body. Psychological states such as anger, frustration, anxiety, depression, irritability, etc. all interact to create a chaotic web that comprises the chronic back pain patient. It is the goal of psychological intervention to help the patient break free from the constricting web of psychological factors that present as a barrier to pain control, reduction in disability, and better psychological adjustment.

Although the study of chronic back pain is not new to psychology, the treatment of CBP by psychological intervention is a recent phenomenon. A number of psychological treatment models have been employed in the treatment of CBP, all purporting some measure of success. It is to that end that this study addresses itself, that is, to look at the efficacy of a specific treatment variation not

previously examined in relation to CBP. The psychological interventions scrutinized are those of relaxation and imagery as modalities in the treatment of chronic low back pain. Before the details of the study are addressed, a number of areas pertinent to the study are reviewed. There is a brief examination of pain theory, the physiology of pain and chemical interventions of pain, followed by a discussion of the psychological correlates of back pain. Following this is a review of psychological models of etiology and intervention of CBP. This includes the identification of critical gaps in the literature in terms of evaluating specific treatment effectiveness. Lastly, the role of relaxation and the utility of imagery in the treatment of chronic back pain is addressed. Following the literature review, the study will be well nested on firm conceptual and empirical ground.

Limitations of the study. The participants in the study were volunteers thereby making the study subject to limitations inherent in volunteer research strategies. Assessment procedures were primarily psychological self-report instruments and questionnaires, therefore subjective in nature. The analysis of the dependent variables (pain, state-anxiety and depression) was univariate. One therapist was used for all four treatment programs. As the author chose not to examine sex differences, only male compensation chronic low back pain patients were used. Hence, in generalizing the results of the study to other populations

(e.g., females or non-compensation males) caution should be taken. Other limitations were that the participants of the study could only receive treatments once per day for one hour, to a maximum of four days per week for a total of two weeks.

Delimitations of the study. The study focussed on variations of psychological intervention with male compensation low back pain patients, aged 18 to 65 years, attending an outpatient Workers' Compensation rehabilitation centre. All subjects were randomly selected from the male chronic low back pain patient population of the centre and randomly assigned to groups, and groups randomly assigned to treatments. The educational scripts and intervention formats (progressive muscle relaxation and/or imagery) were standardized for research purposes and strictly adhered to. Measurement instruments included standardized psychological instruments used in previous chronic pain research.

II. Review of Related Literature

In a time of medical miracles and advances over a variety of human infirmities and diseases there still remains the primordial challenge of developing a safe and effective method for the treatment of pain. It is known that many modern medicines are rooted in techniques developed by ancient civilizations. Bresler (1984) documents how the modern use of morphine, as an effective pain reliever, is derived from opium, a pain killer used by Egyptians 40 centuries ago. Acupuncture and physical therapy are rooted in Chinese medicine which dates back 5000 years. Pain relief is not a recent medical or human concern.

A. The Concept of Pain

The causation and nature of pain has been debated for many centuries. Aristotle conceptualized pain as an emotion, whereas Descarte saw it as a physical stimulus upon the body. The phenomenon of pain has also been interpreted for religious purposes as pain is seen as an experience imposed by God as a form of punishment or as a test of faith (Turk, Meichenbaum & Genest, 1983).

Until the 19th century, theories of pain and causation were limited to armchair conjecture. It was during the 19th century that Newtonian science gave rise to a mechanistic, static version of reality in which human affect and reasoning were replaced by causality and determinism. Hence the development of sensory physiology and psychophysics

argued that affective explanations of pain were unscientific and therefore inadequate. The affective component of the pain experience was relegated to a subjacent position. Even today, theoreticians debate over the relative contributions of emotions, cognitions, and sensory stimulation to the pain experience.

It was during the 19th century that German experimentalists and psychophysicists adopted the scientific approach in the investigation of basic psychological processes (e.g., Muller; Von Helmholz; Weber; Fechner). It was during this period that the first systematic physiological explanations of pain began. It was Muller's doctrine of specific nerve energies that suggested that the brain receives information about external objects only by way of sensory nerves. The nervous system became analogus to the telephone cable system with different coloured wires, each carrying a type of sensation to a particular part of the brain. Von Frey further developed Muller's theory by proposing a congruent doctrine of specific nerve energies by incorporating pain into one of four primary cutaneous sensations, each of which corresponded to four different kinds of receptors evenly distributed over the body (Levit, 1981). The assumption that the skin contains a receptor that operates on a one-to-one relation with a specific stimulus implies a fixed direct-link communication system. This view of pain is one of the most current views and is characterized by its unidimensional focus. That is, pain is

seen as the result of or a function of sensory input. Therefore, it is the physical aspects of a noxious stimulus transmitted by the nervous system that determine the sensations subsequently perceived as pain (Turk, 1978).

The unidimensional view of pain translates into a variety of treatment approaches to control pain. The major premise of the direct-link model suggests that pain can be eliminated or reduced by the removal of a painful stimulus, by the blocking of a pain pathway via an analgesic agent or by surgically severing the pathway so that the pain signal cannot reach its appropriate cortical destination. However, to date none of the more common therapeutic medical procedures implemented to inhibit or modulate noxious sensory input have proven to be completely satisfactory for adequate, consistent, or permanent pain reduction (Turk, 1978). Somatic interventions for chronic back pain also prove inconclusive. Flor and Turk (1984) comment that neurosurgical procedures are especially questionable since they are based on unidimensional, sensory model of pain pathways and pain transmission, disregarding the multi-dimensionality of the pain experience.

Criticism of the direct-link model of pain comes both from clinical evidence and laboratory investigations of the pain phenomenon. Melzack and Wall (1982) report that phantom limb pain, causalgias and neuralgias are but a few examples of clinical evidence to refute the concept of a direct-link nervous system. There are also documented examples of people

who have sustained extensive physical injury and have denied experiencing pain inspite of the tissue damage that could easily account for pain (Beecher, 1959).

Psychological factors that contribute to the pain experience have been uncovered by laboratory investigation. For example, it has been demonstrated that a subject's perception of control results most often in increased pain thresholds and/or tolerance (Bowers, 1971; Staub, Tursky, & Schwartz, 1971). Some investigators have linked pain tolerance and/or perception to early experiences (e.g., Melzack & Scott, 1957), sociocultural background (e.g., Wolff & Langley, 1968), the meaning of the situation (e.g., Beecher, 1959), attentional focussing (e.g., Blitz & Dinnerstein, 1971), and social modeling (e.g., Prkachin & Craig, 1986). Previously neglecting these psychosocial mediators might account for the present inadequacy of the unidimensional sensory pain model.

It was not until Melzack and Wall's (1965) introduction of the gate-control theory of pain that the recognition of complex interactions of pharmacological, physiological, and psychological components to the perception of pain become addressed in a formalized pain theory. With the inception of this theory, pain became conceptualized as multidimensional in nature, incorporating not only physical sensory stimulation but cognitive and affective components as well. Melzack and Wall proposed that neural mechanisms in the dorsal horns of the spinal cord act like a gate which can

inhibit or disinhibit the flow of nerve impulses from the peripheral tracts to the spinal cord cells that ascend to the cortex. Therefore, somatic input is subjected to a modulating influence of the gate before it evokes a pain perception and response. Hence the pain experience is comprised of sensory-discriminative, motivational-affective, and cognitive-evaluative components.

Although the gate-control model of pain has its opponents (e.g., Nathan, 1976), a number of compelling arguments have been put forth in its favour. Reviews of pain literature (e.g., Liebeskind & Paul, 1977; Turner & Chapman, 1982a, 1982b) also emphasize the contribution of cognitive and affective factors to the experience of pain. An exhaustive review of the gate-control model of pain is beyond the purpose of this paper. What is important about Melzack and Wall's perspective is that it is conceptually powerful, lending itself to the study of pain from a variety of disciplines. With the recognition that cognitive and affective factors influence the pain experience, a number of investigators have looked at how the manipulation of psychological mediators supports present medical treatment. In psychology, researchers of various theoretical orientations have begun to look at the efficacy of psychological treatment, as an adjunct to medical treatment, in the adjustment, the reduction, or the abolition of pain.

Before commenting further on the psychological contributions to the study and management of pain it is

useful at this point to provide a working definition of pain. The International Association for the Study of Pain has defined pain as "... an unpleasant sensory and emotional experience associated with actual or potential tissue damage or described in terms of such damage" (ISAP Subcommittee on Taxonomy, 1979, p.250). Hence pain is considered to be both a physical and emotional experience, and upon further pursuing the psychological or emotional correlates of pain a review of the basic physiological mechanisms of pain is required.

B. Physiology of Pain

Peripheral level

The chemistry of the pain experience is initiated at the site of injury even before the pain message is received at the brain. For example, the chemistry of the pain impulse may begin when a person steps on a tack with their foot, thereby causing damage to a set of nerves. Cells ruptured by the tack release their contents causing an increase in acidity around them which activates the enzyme kallikrein. Kallikrein cleaves bradykinin, a pain causing agent, from its inactive precursor molecule. The bradykinin then binds to receptors on the wall of nearby capillaries, causing the junction between the cells to open, allowing infection fighting white blood cells and fluid to leak out. The fluid and dilated blood vessels make the skin swell (edema) and

redden. In addition bradykinin also binds to the receptors on pain nerve endings (nociceptors), causing them to generate a pain impulse. This also serves to make the nerve more sensitive to light touch and gentle heat. Bradykinin also binds to nearby mast cells, causing them to release histamines. In response to all the above peripheral sensory input certain nerve centers in the brain or spinal cord are activated and cause the peripheral nerve endings to release substance P, which also binds to the mast cell (along with the bradykinin) to boost histamine production. As more histamine is released it acts on the capillary walls to further widen the junction so that more fluid, white blood cells, kallikrein and bradykinin precursors leak out. As released bradykinin binds to membranes of many nearby cells it sets in motion a series of reactions that result in the production and release of prostaglandins. Prostaglandins bind to the nerve endings making them fire and intensifying the pain experience. Prostaglandins also promote swelling which remains until healing begins.

Peripheral nocioceptor-dorsal horn link

In general nociceptors can be classified into three groups: high threshold mechanociceptors, heat nociceptors and polymodul nociceptors which respond to both thermal and mechanical stimuli. Specialized peripheral fibres that are known to repond to pain stimuli are found in each of the above groups. The two peripheral fibres that transmit the

pain impulse are a discrete set of A-delta fibres and C fibres. It is believed that A-delta fibres, which are the slowest of the myelinated fibres mediate sharp or immediate pain, whereas the unmyelinated C fibres conduct slow, diffuse or aching pain. Therefore A-delta fibres are implicated in well-localized pain, while the larger C fibres are implicated in a pain experience that is poorly localized.

As the A-delta and C fibres conduct pain impulses destined for supraspinal structures they enter the spinal cord via the dorsal horn. Within the dorsal horn two general classes of interneurons have been identified in relation to pain mechanisms. These neurons are packed within the dorsal horn into layers or laminae. The first type are Class 1 nociceptive cells that share with the peripheral nociceptors the property of specific responsiveness to noxious stimulus. Class 1 cells receive input only from A-delta and C fibre cells, and are located at the marginal zone of the dorsal horn (Liebeskind & Paul, 1977). Class 2 nociceptor activity is not specific to A-delta or C fibres but as the intensity of the peripheral stimulus is increased to noxious levels, these cells in turn respond maximally with vigorous and prolonged discharge. These are located in the deeper layered laminae 4 to 6 (Liebeskind & Paul, 1977).

Laminae 2 and 3 contain the cells that comprise the substantia gelatinosa (SG), an area of crucial importance to Melzack and Wall's (1965, 1982) original gate-control theory

of pain. Their theory as originally proposed suggested that the SG cells exerted presynaptic inhibition on large and small fibre terminals as they synapsed on the transmission cells of the dorsal horn. Large fibres were thought to excite the SG thereby inhibiting transmission by enhancing presynaptic inhibition (closing the gate), while small fibres facilitated transmission by inhibiting the SG (opening the gate). Hence pain perception was credited to the spinal gate being open or closed relative to the activity of large fibres in relation to small fibres. However further neurological research discovered that thin or small fibres also produced synaptic inhibition rather than facilitation (Zimmerman, 1979) thereby requiring Melzack and Wall (1982) to revise their original hypothesis.

In Melzack and Wall's most recent gate-control version the SG is now seen as containing the multiple functions of excitatory and inhibitory links to the transmission cells (T-cell) and a descending inhibitory control from brainstem systems. A descending inhibitory control was added to account for increased evidence of a significant brainstem inhibiting system that influenced sensory input after T-cell stimulation. They have also proposed the role of peptides in their gate theory given evidence that certain nerve fibres (especially unmyelinated fibres) are rich in peptides and that neuropeptide concentrations change for several days following peripheral injury. Is is also their contention that following peripheral nerve damage, there is a change in

the terminals of fine fibres within the spinal cord and concomitant disinhibition. Given this action, the receptive fields of the transmitting cells expand which leads to a condition in which there is greater probability of activating the T-cells and thereby triggering the pain response action system. Transmissions to higher cortical structures are controlled by the traditionally perceived nerve impulse and the slow transport and release of neurochemicals which structurally modify the T-cell and thereby activity.

Higher order mechanisms of pain

Following the transmission of the pain impulse from the SG the impulse continues to higher cortical structures via the spinothalamic tract (lateral and ventral). The spinothalamic fibres connect with several levels of the reticular formation (arousal and attention functions) as they ascend from the spinal cord. One cluster of cells implicated in the pain experience is the nucleus gigantocellularis (NGC) of the reticular substance. It is reported in animal studies that the NGC respond to activation of A-delta and C fibre cells, and that stimulation leads to aversive behaviours similar to those elicited by pain stimulus (Liebeskind & Paul, 1977). Further to this discovery it has also been found that the injection of bradykinin results in higher NSG activity.

At the midbrain level, the central gray matter and periaqueductal gray matter (PAG) are known to possess cellular mechanisms that exert influence in the pain transmission. Stimulation (electrical) of this area not only blocks pain but inhibits NGC activity, a phenomenon called stimulation produced analgesia (SPA). The resultant analgesic effects of SPA are similar to those produced by morphine. Both morphine and SPA suppress nociceptive responses in the dorsal horn cells and their effectiveness for pain suppression is reduced by an injection of naloxone.

Hence pain projections from the spinothalamic tract enter several cortical structures including the thalamus, the limbic system and the cerebral cortex. The cerebral cortex, PAG and serotonin-releasing nerves in the raphe nucleus are involved in the descending modulation of pain signals.

Descending pain control

Based upon electrical stimulation studies of specific brain sites of animals (e.g., SPA research) it was posited that there was evidence for the existence of an endogenous analgesic system. Neuropharmacological studies have demonstrated the existence of receptors in the brain that are sensitive to opiate compounds. Opiate receptors are specific sites on cell surfaces that are stereoselective, that is, a specific key (opiate drug) will only fit a specific lock (opiate receptor). As opiates do not exist

naturally in animals, it followed that if opiate receptors do exist in the brain, these receptors have a physiological function, therefore there must be a natural opiate-like substance. In a scientific search to discover the endogenous substance, two naturally occurring morphine-like substances were discovered: leucine-enkephalin and methionine-enkephalin. Other endorphins have since been discovered. These substances have profound analgesic effects when administered intraventricularly or systematically (Feuerstein, Labbe & Kuczmierczyk, 1986). There is evidence that enkephalins are neurotransmitters of a specific neuronal network in the brain involved in the mediation of pain and emotional behaviour. Snyder (1977) noted that enkephalin containing nerve terminals are concentrated in the SG, the amygdala of limbic system, and the thalamus. It is further proposed by the above author that enkephalin neurons have an effect in pain modulation by their inhibitory effect on the excitatory neuron which is attempting to promote the transmission of a pain impulse to a receiving cell. Essentially the idea is that rather than acting upon the receiving cell, the enkephalin may block the release of the excitatory neurotransmitter from the excitatory neuron directed toward a receiving cell. By reducing the net depolarization, the amount of neurotransmitter released from the excitatory transmitter is reduced proportionately so that the receiving cell is exposed to less stimulation and as a result its firing rate

is reduced.

In summary of the physiological mechanisms of pain, there exists a degree of specificity which can be observed at all levels of the transmission of the pain impulse. However, as Liebeskind and Paul (1977) point out, specificity at higher cortical levels is not well understood and techniques to determine such mechanisms of cerebral pain modulation are too intrusive for human research. In keeping with the tripartite organization of the pain experience as presented by Melzack and Wall (1982), peripheral receptors and those mechanisms linked to the initiation of the pain impulse contribute to the understanding of the sensory-discriminative aspects of pain. Brainstem research contributes to the motivational affective components of pain. However our understanding of the cerebral mechanisms of pain are limited hence the cognitive-evaluative component of pain is not well understood. The safest course in describing the physiological aspects of the pain response is not to focus or isolate any one specific mechanism but rather to understand the phenomenon as centripetal in action.

C. Pain: Chemical Interventions

Given the above review on the physiology of pain it follows that any study in the area of chronic pain necessitates a review of common chemical interventions for pain. Often pain patients will quickly generalize their

previous success in the use of medication for acute pain to their persistent pain condition. This misleading assumption can cause a host of iatrogenic complications with the use of medications over a long period, and further may cause the patient to remain passive in a therapeutic sense as opposed to active in adjusting to a problem that often requires lifestyle changes. Nevertheless numerous medications are prescribed for people who suffer from chronic pain and its associated secondary effects (e.g., emotional lability).

Analgesics

There are two basic categories of analgesics: peripheral acting agents (e.g., aspirin) and other nonsteroidal anti-inflammatory drugs (NSAIDS), and the central nervous system acting narcotic analgesics. In the first category the best known analgesic is aspirin. Aspirin and other NSAIDS act by inhibiting the synthesis of prostaglandins, the substance previously mentioned as sensitizing free nerve endings to bradykinin. In relation to its use in the chronic pain population, the advantage is that there is a ceiling effect in which increased medication dosage does not lead to increased analgesic effect. In spite of this pharmacological ceiling effect, Brena (1983) has noted that chronic pain patients tend to take a variety of pills with little regard to their known ceiling effects. Other medications whose primary focus is the inhibition of prostaglandin synthesis include ibuprofen (Motrin and

Advil), indomethacin (Indocin) and naproxen (Naprosyn).

Acetaminophen is a substitute for people who cannot tolerate aspirin due to its known side effects (e.g., gastritis, etc.). A drawback of these drugs (e.g., Tylenol and Datril) is that they do not have the anti-inflammatory properties required for certain injuries. Acetaminophen is equal in its analgesic efficacy to aspirin (Gerald, 1981) and may be the preferred analgesic for chronic pain patients who do not need anti-inflammatory agents. Acetaminophen does not significantly effect prostaglandin synthesis in peripheral tissues and the process by which it produces analgesia is largely unknown (Aronoff, Wagner & Spangler, 1986). Aronoff et al. (1986) conclude in their review of chemical interventions for pain that in general, NSAIDS may be most useful for chronic pain conditions associated with inflammation, including low back pain. They further conclude that because of the availability of these medications they are undervalued by chronic pain patients who often request a more powerful analgesic. One advantage of the peripheral acting analgesics is their low rate of observed misuse (Aronoff et al., 1986; Brena, 1983).

Narcotic analgesics

Narcotic medications or central acting analgesics form the second group of pain killers. Narcotic agents (also referred to as opiates) are potent analgesics effective for the relief of severe pain. Narcotic agents may be classified

into four categories: (1) the natural alkaloids of opium (opiates), which include morphine and codeine; (2) the semisynthetic derivatives of morphine, chemicals which are chemical modifications of the morphine structure; (3) synthetic narcotic agents or opioids which bear molecular similarities to the structure of morphine; and (4) narcotic antagonists often used as antidotes to antagonize respiratory depression caused by an overdose of a narcotic analgesic (Gerald, 1981). In general, narcotics act on the central nervous system (CNS) by binding to opiate receptor sites and activating an endogenous pain modulating system. To date, no drug has been developed that is more effective for the relief of severe pain than morphine, and therefore it remains as the standard for comparison. Other narcotic agents include: (1) codeine; (2) semisynthetic derivatives such as hydromorphone hydrochloride (Dilaudid) and oxycodone (Percodan); (3) opioids, synthesized compounds with morphine-like effects such as meperidene (Demerol), methadone and propoxyphene (Darvon); and (4) the mixed opiate agonist-antagonists like Talwin (Aronoff, Evans & Spangler, 1986).

The major problem of these medications in relation to their use in the treatment in chronic pain is the reality of imminent tolerance and possible physical dependence or addiction. Katon (1984) noted that because chronic pain is often associated with anxiety and depression, the potential of narcotics to induce euphoria and mood alteration is

especially problematic. Hence narcotic usage may potentially exacerbate concomitant psychosocial problems. As well, narcotic use may cause cognitive impairment effects in chronic pain patients, thereby making it difficult for them to learn non-medication pain management strategies (McNairy, Maruta, Ivnik, Swanson & Ilstrupp, 1984). Lastly, a concentrated focus on medication for pain management does a disservice to the chronic pain patient as it instills a faith for a unidimensional solution to a multidimensional problem.

Secondary medications

Often medications other than those that are primarily given for pain relief are found in use with the chronic pain population. These medications include: barbituates, benzodiazepines, anti-convulsants and anti-depressants. Anti-depressants will be discussed following a review of the above medications, as their use warrants special treatment in this section. Aronoff, et al. (1986) provide an excellent review of the use of these secondary medications in the chronic pain population and therefore they will be used as the major source of reference in this section. Barbiturates act to depress sensory cortex activity, motor functions and produce drowsiness or sleep. They provide very little analgesic effect and are known to increase one's reactions to painful stimuli. Brena (1983) noted that barbiturates are habit forming and one of the most common drugs to produce

adverse effects and dependence (e.g., Fiorinal). Anti-anxiety medications (e.g., Valium or Xanax) are benzodiazepines and also act to depress CNS activity. Katon (1984) noted that the benzodiazepines are often prescribed inappropriately to chronic pain patients with concurrent depression, even though anti-anxiety agents have no proven analgesic effect. There also exists evidence that the benzodiazepines deplete the neurotransmitter serotonin, adding to depression and pain. The conclusion drawn by Aronoff et al. (1986) is that sedative-hypnotics and anti-anxiety medications have little place in the long term management and adjustment to chronic pain.

Muscle relaxants or anti-spastic agents include methocarbonal (Robaxin) and carisprodal (Soma) which are CNS depressants. Robaxin has no direct effect on contractile mechanisms of striated muscles and thus does not relax tense muscles. Soma blocks activity of the descending reticular formation (Aronoff et al., 1986). Bacoflen (Lioresal) and dantrolene (Dantrium) are more accurately true muscle relaxants. Bacoflen has some CNS depressant properties but its main focus of action is to reduce the release of substance P from nociceptive afferent nerve endings. Dantrolene does not reach the CNS, acting peripherally to decrease muscle tension.

The anti-convulsant class of drugs, for example phenytoin (Dilantin) are effective in the treatment of neuralgias. These drugs act to suppress random spontaneous

neuronal firing by stabilizing the membranes of myelinated and unmyelinated afferent neurons.

Anti-depressants and the endorphins

The use of anti-depressants in the chronic pain population is a well-established treatment mode given that a pain patient often benefits two ways from such an intervention. The most obvious observation is that depression often occurs as a concomitant phenomenon of chronic pain and that a chemical intervention that is effective in ameliorating the symptoms of depression (e.g., self-esteem problems, sleep patterns) can reduce the experience of suffering. Furthermore biochemical studies suggest a similarity between pain and depression (Ward et al., 1982). Hence there has since developed a strong research interest to evaluate the relationship of the biogenic amines, serotonin and norepinephrine, and the endogenous opiates.

Both serotonin and norepinephrine have been implicated in depression and the evidence is that depressed individuals have a lower concentration or turnover of either one of these two neurotransmitters. Sternbach, Janowsky & Huey (1976) suggested that decreased serotonin may be common in both chronic pain and depression. This may account for the reason why tricyclic anti-depressants, which block the re-uptake of serotonin, may effectively treat both conditions. Doxepin (Sinequan or Adapin) has been found to

be a particularily effective block for the re-uptake of serotonin resulting in the increased concentration at the synaptic cleft in ratio to norepinephrine levels. Evidence to date suggests that the alteration of serotonin/norepinephrine balance in favour of serotonin may inhibit pain responsivity (Hendler, 1982). Other tricyclics with proven effectiveness in chronic pain populations include: amitryptyline (Elavil), imipramine (Tofranil) and clomipramine (Anafranil).

In determining the role of the endorphins in the chronic pain/depression relationship it has been posited that chronic pain patients may have low endorphin levels and are therefore unable to reduce the net effect of pain. However, it appears that the relationship between chronic pain and endorphins is mediated by mood and therefore the neurotransmitters serotonin and norepinephrine. As a case in point, chronic pain patients who were diagnosed as exhibiting psychogenic pain and more depression, manufactured high levels of endorphins without resolving their chronic pain problems (Von Knorring, Johansson & Almay, 1982, cited in Aronoff et al., 1986).

To account for these findings Ward et al. (1982) proposed that transmission of pain information via the paleospinothalamic tract resulted in the production of endorphins as a homeostatic response. Although endorphins are known to effect the neospinothalamic tract, which transmits sharp acute pain impulses (few neuronal

connections), they do not appear to influence pain transmitted by the paleospinothalamic tract (chronic pain information passage). However it has been found that serotonin and norepinephrine do affect firing along the paleospinothalamic tract and thus can account for the influence tricyclics have on reducing the pain experience.

Given the surmounting evidence from neurophysiological research and pharmacological intervention that links the emotions with pain, it follows that physical and emotional correlates are strongly bound in the complex phenomenon of pain. Given this physiological backdrop it is now appropriate to focus discussion on the psychology of pain and in this study, in particular, chronic low back pain.

Recently, psychological interventions in chronic low back pain have been employed. Before looking at various psychological treatment models, the psychological correlates of chronic low back pain (CLBP) will be reviewed. Any psychological variables that may affect pain adjustment, recovery, medical rehabilitation, and general emotional well-being should be addressed as the health professional should be cognizant of factors contraindicated to success.

D. Psychological Correlates of Low Back Pain

As previously mentioned, in the gate-control model, pain is seen as a resultant experience of sensory-discriminative and motivational-cognitive-affective factors (Melzack, 1973; Melzack & Dennis, 1978; Melzack &

Wall, 1965, 1982). While the former component is primarily physiological in nature, the latter component catapults the pain phenomena into psychological inquiry. If the latter component is dissociated from the sensory experience of pain, this can lead to manifestations of pain exaggeration and further a characterization of pain as being either functional or organic in nature.

A variety of personality assessments have also been employed to seek profiles of low back pain (LBP) sufferers (e.g., Murray, 1982). The Minnesota Multiphasic Personality Inventory (MMPI) is one such measuring instrument used (Fordyce, 1976). The psychosomatic or "conversion V pattern," composed of clinical elevations on the Hysteria (Hy) and Hypochondriasis (Hs) scales, and moderate to high elevation of the Depression (D) scale have been used to characterize somatic complaints, including back pain (Archibald, Bell, Miller, & Thompson, 1961; Brena, Wolf, Chapman, & Hammonds, 1980; Freeman, Calsyn, & Louks, 1976; Hanvik, 1951). However, the "conversion V" is not precise enough to warrant use for individual diagnosis (Sternbach, Wolff, Murphy, & Akeson, 1973a), nor to discriminate between organic versus functional LBP patients (Fordyce, 1976a; Leavitt & Garron, 1979; Strassberg, Reimharr, Ward, Russell, & Cole, 1981) because the two groups are not mutually exclusive (Rosen, Frymoyer, & Clements, 1980). However, the Hy scale was a good predictor of patients who, when tested 6 to 12 months later, were most responsive to therapy in terms

of returning to work and reduction in the intensity of pain (McCreary, Turner, & Dawson, 1979).

The "conversion V" is said to characterize the profile of a patient where pain is difficult to diagnose. By an extension of logic, where evidence is lacking for pathophysiology, pain is presumed to be a symptomatic expression of underlying emotional conflict (Hanvik, 1951). High Hs and Hy, and lower D scores signal successful neurosis because high somaticization serves to deny the emotional disturbance, therefore the depression is not readily apparent. Patients focus on their back pain so they are not depressed. However, Leavitt (1985) found that the "V pattern" is not an appropriate clinical marker of assessing psychogenic pain suggesting the V pattern may be the result of a historical accident of scale placement. Overall, the use of the MMPI in diagnosing LBP, including the functional versus organic demarcation, proves inconclusive.

A variety of intrapsychic factors may contribute to an increase in the perception of pain, or the reaction to pain, as well as minimize a healthy tolerance to pain. For example, Sternbach (1974, 1978) observed that stress, anxiety, and depression are states often found in chronic pain patients. Excess stress resulting from home, work, finances, relationships, etc. can exert influence on the body leading to pathophysiological changes that can cause pain and decreae tolerance to pain. Muscle tension, implicated in tension headaches and myofascial pain (Kudrow,

1976, cited in Barber & Adrian, 1982), is but one example. Sternbach (1974) found that increased incidence or frequency and severity of stressful life events predated initial injury of an original acute pain period. Continued stress can lead to chronic anxiety and resulting depression.

Depression is one of the most intriguing and puzzling intrapsychic phenomenon commonly associated with chronic pain. The diagnosis of depression and depressive disorders is one of the more complex areas in psychology and the presentation of chronic pain further confounds the problem of diagnosis. Psychologists readily acknowledge the importance of evaluating depression in chronic pain patients (e.g., Fordyce, 1976b; Sternbach, 1974), however research in this area suffers from a number of limitations that prevent definitive conclusions from being drawn (e.g., Romano & Turner, 1985; Rudy & Turk, 1988; Turk, Rudy & Stieg, 1987). Part of the difficulty of diagnosing depression, regardless of the presence or absence of chronic pain, lies in the fact that depression can present in three basic forms: a) as a normal affect or emotion, such as sadness; b) as a sign or symptom of situational reaction; and c) as a clinical syndrome (Simmons, Rubinstein & Franks, 1985). Furthermore all three forms of depression may exist along a continuum.

Further problems arise out of the fact that depression as a primary affective disorder may present with psychological and/or physical symptoms, and some physical illnesses can present with depression as the only symptom.

Some authors report that 55 to 65% of psychiatric outpatients (Sternbach, 1974; Von Knorring, 1975) and inpatients (Von Knorring, Perris, Eisemann, Eriksson and Perris, 1983) who are depressed will have a coexisting pain complaint. Stress of chronic illness may also result in an adjustment disorder, grief-like reaction or demoralization which present symptoms similar to those reported for depressive disorders (Turk, Rudy, & Stieg, 1987). Thus the presentation of a medical illness may also lead to the diagnosis of depression (Cavanaugh, Clark & Gibbons, 1983; Rodin & Voshart, 1986) because of the similar somatic or vegetative symptoms (e.g., poor/increased appetite, weight gain or loss, psychomotor agitation, diminished ability to think, etc.). Typical features of chronic pain, however, confound using DSM-III criteria for the diagnosis of a major depressive episode (Turk, Rudy & Stieg, 1987). For example, people with chronic pain often take medications that can produce sleep abnormalities, psychomotor agitation, or diminish a person's cognitive abilities. If an individual is suffering from chronic low back pain, it is likely that their physical abilities will be restricted and reduced, thus facilitate weight gain. Hence the confounding problem of chronic pain in the diagnosis of depression may account for the high prevalence of diagnosed depression in the chronic pain population.

The use of various standardized instruments, such as the Beck Depression Inventory (BDI), the Hamilton Rating

Scale for Depression (HRSD) and the Depressive Adjective Checklist (DACL) all suffer from the same problem as is found in the use of the DSM-III criteria in relation to chronic pain patients, namely a preponderant number of questions related to somatic and vegetative signs of depression which are more likely to be endorsed by chronic pain patients. Further to this, the variations of depression as previously mentioned pose a problem in self-report measures because of variations in cutoff scores in relation to the number of somatic versus cognitive questions contained within a self-report to warrant the diagnosis of depression. The concern is making too many false positive or false negative classifications based upon known confounds to the diagnosis of depression with the chronic pain population. In addressing this issue, the BDI was evaluated with respect to sensitivity and specificity of diagnosis with the chronic pain population and it was found to be one of the better detectors of depression as concurrently confirmed by a structured psychiatric interview (Turner & Romano, 1984).

Being mindful of the caveats pertaining to the chronic pain-depression link, surmounting evidence suggests a relationship between depression and chronic low back pain (e.g., France, Houpt, Skott, Krishnan & Varia, 1986; Garron & Leavitt, 1979; Keefe, Wilkins, Cook, Crisson, & Mulbaier, 1986; Levine, 1971; Levit, 1973; Maruta, Swanson, & Swanson, 1976; Murray, 1982; Sternbach et al., 1973a). As well,

depression is one of the neurotic triad MMPI scales in which LBP patients, both of functional and organic distinction, had higher than normal scores (Gentry, Shows, & Thomas, 1974; Gilberstadt & Jancis, 1967; Leavitt & Garron, 1980; Murray, 1982).

Although there is growing consensus that depression affects a chronic pain patient's adjustment, there is little consensus among the researchers as to the exact nature of the relationship. This lack of agreement accounts for the many theories propounded to address the chronic pain-depression relationship. Some reseachers suggest that the complaint of chronic pain in the absence of significant findings is merely a manifestation of a pain-prone individual who suffers from a muted depressive state (e.g., Blumer & Heilbronn, 1982). Authors of this school of thought cite as evidence the efficacy of tricyclic antidepressants in relieving coexisting pain and depression. In a criticism of the pain-prone personality, Rudy and Turk (1988) point out that over 100 published articles to date have failed to find a specific personality type to account for the depression chronic pain link. With respect to the use of antidepressants as proof of Blumer & Heilbronn's hypothesis, and those who also promote a biological model that links chronic pain and depression (e.g., Ward, Bloom, Dworkin, Fawcett, Narasimhachir & Friedel, 1982), Loeser (1979) suggested that the beneficial effects of tricyclic drugs in treating chronic patients may be due to the restoration of

normal circadian rhythms or as a counter-acting effect to other concurrent prescribed medications that disturb endogenous rhythms and intellectual abilities.

The depression-chronic pain link has also been addressed within the cognitive-behavioral model. The hypothesis of this model suggests that depression is a function of reduced instrumental activity which results in concomitant declines in social relationships, sense of personal control and mastery, etc. As an example a high frequency of cognitive distortion has been observed in depressed CLBP groups (Lefebvre, 1981). Related research demonstrated that there exists a strong tendency for CLBP patients to have negative self-concepts. Armentrout (1979) revealed that low self-esteem distinguished LBP patients. Sternbach, et al. (1973a) believed that a defective self-concept and lifestyle were one characteristic of CLBP patients. There also exists a strong tendency for CLBP patients to have a negative self-concept which translated into poor behavioral performance. For example, Schmidt (1985) noted negative self-concept CLBP patients performed poorer in physical tasks of behavioral persistence (e.g., treadmill walking) in spite of the fact that poor performance was unrelated to reported pain level or poor physical condition. Typically CLBP patients overrated the actual individual effort exerted in the behavioral tasks, losing touch with their internal sensory input system and mislabelling or misinterpreting the cues of exertion for

pain. A vicious cycle develops in which negative self-concept leads to poorer performance leading to negative expectations and continued low performance, spiralling downward until the patient succumbs to the 'disease conviction,' operating as a 'pain prone low back loser'. These documented cognitive distortions and negative self-concepts are one of the major areas focussed upon in a cognitive-behavioral treatment intervention for pain (e.g., Turk, Meichenbaum, & Genest, 1983).

Because negative expectations are typically present in CLBP patients a common exasperated comment by the patient is "I'll never get rid of my pain". If one were to employ an attribution model, as conceptualized by Weiner (1974), to the negative expectation set, it is no surprise that this cognitive stance is so difficult to change if the early experience of back pain is attributed to a stable factor (chronic pain) and an external locus of control (the back pain) which can be influenced only marginally. The initial pain event may also lead to negative expectations manifesting in a fear of anticipated pain. Melzack (1973) emphasized the role of memory in the pain experience noting that if the previous pain experience is disabling then a person is more sensitive to fear future pain.

The role that depression plays in the experience of chronic pain is complex and research is equivocal as to the exact nature of this relationship. Nevertheless there is a general consensus that the depression-chronic pain link

exists. Depression can potentially affect the way a chronic pain patient describes, displays, adjusts or rehabilitates to their condition. Minimally, individuals who suffer loss (e.g., personal, vocational, financial) as a result of an industrial accident are likely to suffer from a reactional depression concurrent with the development and duration of a chronic pain syndrome (Sternbach, Wolf, Murphy & Akeson, 1973a; Turk & Salovey, 1984). Depression is but one of a host of psychological factors that can affect the chronic pain experience.

Another psychological factor that exerts influence in the CLBP syndrome is the individual's initial reaction to pain. People react to the initial respondent pain (Fordyce, 1976) differently leading to different coping approaches. Those who confront pain find it a temporary nuisance. They are also strongly motivated to return to work and resume normal social and leisure activities (Lethem, Slade, Troup, & Bentley, 1983). They confront the pain barrier as the organic resolves naturally or in response to medical management (Slade, Troup, Lethem, & Bentley, 1983). Those who took this active approach realized better recovery rates. The other coping approach demonstrates both cognitive and behavioral avoidance. This type of response leads to a number of psychological and physiological consequences: inactivity and resultant loss of spinal mobility and muscular strength, concomitant weight gain, depression, anxiety, etc. This passive approach is one characterized by

withdrawal. Often analgesic treatment is the only treatment sought. The passive approach can lead to drug dependency. Once the client realizes dependence on medication it fortifies the external locus of control both for the management or coping of pain and the impetus for the healing process, an ideation counterproductive to optimal rehabilitation. It is this second approach, avoidance, that typifies a CLBP patient.

Personal coping strategies have been documented to help individuals to tolerate, minimize, or reduce pain (Lopp, 1974; Tan, 1982). Rosenstiel and Keefe (1983) factor analyzed coping mechanisms into three factors: (a) cognitive coping and expression which included reinterpretation of the pain sensation, coping self-statements and ignoring pain sensations; (b) helplessness which includes controlling castrophizing thoughts, increasing activity levels and control, and ability to decrease pain; and (c) diverting attention and praying. Surprisingly, the use of these particular kinds of coping strategies was not related to better adjustment and in fact may promote poorer adjustment. Refraining from the use of a castrophizing strategy (e.g., I worry all the time about whether it will end) was most useful as this is related to poorer emotional adjustment assessed by anxiety and depression, rather than pain reduction. The authors commented that the patients' use of these strategies may have been more effective if they had undergone a systematic coping skills training program.

A final note in this section dealing with psychological correlates of low back pain is a consideration of secondary gain in the pain response. The health professional must be cognizant of secondary gain in the pain experience as it has been documented that the severity and frequency of stressful events reduced with time as the patient further developed an "invalid role" (Lethem et al., 1983). In other words, the quality of life was improved by pain. Hence, secondary gains present as an added complication that becomes increasingly important during a rehabilitation process. Some patients often cling to their symptoms as it is the only way to elicit the solicitude of friends and relatives. Pain rating can be exacerbated significantly by a solicitous spouse, and the pain complaint can be maintained in cases where financial compensation is concerned even if therapeutic intervention is applied (Block, Kremer, & Gaylor, 1980a, 1980b). The latter component identifying financial compensation as playing a role in the pain problem identifies the "compensation neurosis" controversy. It is argued that psychological symptoms that occur after an injury or accident in which a compensation claim is possible or pending are maintained, irrespective of the physical damage sustained, by the potential claim. However, in a review of the compensation neurosis literature, Weighill (1983) noted a number of difficulties in terms of research being limited in scope and design thereby making a clear conclusion about the compensation neurosis phenomena

spurious at best. In respect to litigation or financial compensation, recent research finds no support that personal injury litigants describe their pain more severely than do non-litigants, squelching the notion that CLBP litigants are cured by verdict (Mendelson, 1984).

In summary, only a few of the psychological correlates to CLBP have been discussed. This review is certainly not exhaustive, but for the purpose of this discussion adequately identifies major factors implicated in CLBP syndrome. These highlighted factors are essential elements to be considered by a practitioner in the area of CLBP regardless of the therapeutic intervention to be implemented. The next section will focus on psychological models used to conceptualize possible causes of chronic back pain, followed by a critical review of psychological intervention models.

E. Etiology of CBP: Psychological Theories

Clinical experience and research has shown that psychological factors can drastically alter the pain experience for an individual. As a result, a number of psychological models have been used as templates in an attempt to understand the CBP phenomena. The following is a review of the psychological theories that attempt to account for the development of CBP from a psychological perspective. Many of these psychological theories are concerned with the transition of acute to chronic back pain.

Behavioral models

The behavioral model is comprised of respondent and operant approaches to the study of the etiology of CBP. In a classical conditioning model proposed by Gentry and Bernal (cited in Turk & Flor, 1984), they suggest that pain and tension may originally occur in a perceived pain state as a result of physical damage initiating a pain-tension cycle. Pain is seen as preceding muscular hypertension and as a reaction to the resultant muscle tension. As a consequence, movement is avoided with the purpose of reducing pain, leading to increased immobility, and therefore increased pain and tension, and so on. In the course of time, many situations begin to elicit pain, anxiety, and depression, all of which intensify the pain-tension cycle. It is assumed that when an acute pain problem exists, a conditioned fear of movement develops which serves to decrease activity level leading to immobilization. The end result of this sequence is possible muscular atrophy and increasing disability. Turk and Flor (1984) note that although preliminary data is available for these assumptions, by and large, present empirical evidence is not satisfactory. For example, Collins, Cohen, Naliboff, and Schandler (1982) did not find any differences in lumbar EMGs between healthy controls and low back pain subjects while in different body positions. Turk and Flor (1984) conclude that most studies from this framework are hampered with methodological problems such as the lack of diagnostic criteria for patient samples, and few

comparative studies, both of which reduce the explanatory power of this model in accounting for the etiology of CBP.

The operant model of CBP stems from the work of William Fordyce and his colleagues over the last 15 years (Fordyce, 1976a, 1976b, 1978; Fordyce, Fowler, & Delauter, 1968; Fordyce, Fowler, Lehmann, Delauter, Sand, & Treischman, 1973; Fordyce & Steger, 1979; Steger & Fordyce, 1982). This model emphasizes observable and quantifiable pain behavior. This perspective proposes that acute pain may come under the control of external contingencies of reinforcement thereby developing into a chronic pain problem. Pain behavior (e.g., grimmacing, moaning, medication dependency, etc.) may be reinforced by a spouse, or medical personnel. Furthermore, pain behavior may be maintained by an avoidance of undesirable behavior such as work or sexual activity. Often direct rewards can maintain pain behavior (e.g., a litigation claim). The treatment approach is designed to manipulate factors that are hypothesized to exert control over a patient's pain behavior. The goals of treatment are to reduce maladaptive behaviors, increase activity levels, and decrease analgesic medications. The value of the operant model is that it lends itself to a quantifiable behavioral examination of pain behavior and the reinforcers in the environment that maintain such behavior. However, more research is required to demonstrate how valid this model is in explaining the transition of acute to chronic pain by systematic manipulation of "well behavior" and "pain

behavior" of patients in their natural environment (Turk & Flor, 1984).

Cognitive-behavioral and social modelling perspectives

A cognitive-behavioral approach to the study of CBP emphasizes the cognitive processes involved in coping and adjusting to pain. It is assumed that cognitive distortions or maladaptive evaluations alter the experience of pain which in turn leads to feelings of helplessness and loss of control. As a result, an initially presenting acute pain experience may evolve into chronic pain. It is an effort on the part of various researchers in this area (e.g., Meichenbaum & Turk, 1976; Tan, 1982; Turk & Genest, 1979; Turk, Meichenbaum, & Genest, 1983) to reduce feelings of hopelessness in the patient allowing the individual to regain control over the pain experience leading to better rehabilitative adjustment. However, Turk and Flor (1984) point out that little empirical work has been directed at testing cognitive-behavioral assumptions in regards to the etiology of CBP, therefore the assumptions remain suggestive at best.

The social modelling perspective also offers possible insights into the etiology of CBP. Research has demonstrated how the social modelling process may inhibit or disinhibit reactions to pain (e.g., Craig, 1978). Laboratory studies have demonstrated that subjects exposed to others tolerant of pain give evidence of reduced pain in a variety of

psychophysical, behavioral, and psychophysiological measures (Craig & Prkachin, 1978; Prkachin & Craig, 1985, 1986). Exposure to intolerant models tends to produce opposite effects (Craig & Coren, 1975). In a related vein, research into family systems also lends credence to the importance of social modelling influences in the experience of acute pain and transition to chronic pain. For example, Waring (1977) suggested that a physical symptom may appear initially as a brief acute pain incident and then evolve into a chronic pain problem if the symptom fulfills certain family needs, that is, by scapegoating or projection. Those needs will lead to the reinforcement of symptoms and a "sick-role homeostasis" will stabilize the family system. Other types of familial characteristics have been implicated in the psychosomatic illness area. Grolnick (1972) identified family rigidity as leading to the onset of psychosomatic illness, an area often identified with CBP. Birth order has been cited as a contributing cause for the onset of CBP. Gentry, Shows, and Thomas (1974) reported that CBP sufferers tend to be later born children with many siblings. These results are in controversy as Ziesat (1978) did not replicate these findings. Other authors (e.g., Block, 1981; Mohamed, Weisz, & Waring, 1978) have researched and found support for the notion that "pain runs in families," that is parents, siblings, spouses, and relatives of patients with CBP have a significantly higher number of pain complaints than controls. Hence not only does social modelling

contribute to individual differences in response to pain but recent field observations in clinical and family studies (e.g., Edward, Zeichner, Kuczmierczyk, and Boczkowski, 1985; Violon & Guigea, 1984) continue to highlight the importance of familial influences in the perception of pain.

In summary of the social modelling and family systems perspective in relation to the etiology of CBP, it appears that as an explanatory framework this approach makes interesting suggestions about the development of chronic pain states and considers the psychological factors typically neglected by somatic models. With the exception of Craig's research, empirical evidence for these models is sparse, however. Turk and Flor (1984) recognize the need for more refined and precise research in this area.

Psychoanalytic model

The psychoanalytic model also offers an explanation for the development of CBP syndrome. However, problems in this perspective are linked to original psychoanalytic theory, that being the theory itself cannot be subjected to scientific testing and much of the work is retrospective by nature. A psychoanalytic description of back pain would be conversion neurosis, depression, or a hypochondriacal disorder. Freud (cited in Turk & Flor, 1984) viewed pain as conversion neurosis resulting from an inability to compromise a forbidden wish fulfillment and its negative consequence. It was Engel's (1959) work on psychogenic pain

and pain-prone individuals that modernized the psychoanalytic position in the regulation of psychic being. Chronic pain becomes viewed as a somatic expression of an unresolved conflict or psychic pain. He characterized the pain-prone individual as having noticeable guilt, a history of suffering and defeat, an unfulfilled aggressive drive, and the development of pain upon loss or perceived loss. Others of this perspective (e.g., Blumer & Heilbronn, 1982) have extended Engel's work to conceptualize pain of unknown origin as directly linked to depressive mood disorder. They go on to identify a number of clinical features, such as: denial of conflicts; inability to enjoy social life, leisure, or sex; insomnia; dependency; depressive mood; and a family history which may include depression, alcoholism, or a relative with chronic pain. Accordingly, this perspective translates into a treatment of anti-depressant medication as the individual suffers from a psychobiological disorder that is depressive in nature.

In summary of the psychoanalytic model, it appears that this perspective raises interesting issues in relation to the development of a chronic pain-prone individual and the accompanying clinical markers. However, this perspective suffers from a historical shortcoming dating back to Freud's original assumptions which prove scientifically untestable. Although many of the clinical features identified by researchers in the area can be easily identified as present in the chronic pain sufferer, it is the causality that is a

point of controversy. Again, it is difficult to determine whether or not depression precedes the development of pain, is secondary to the presence of pain, or occurs simultaneously. This perspective does not lend itself to methodological design, as research is typically retrospective, and therefore lacks statistical support for its main assumptions.

F. Psychological Treatment Approaches to CBP

Just as there exists a number of psychological theories to the development of CBP, so does there exist innumerable psychological treatment methods. Each of the treatment approaches is akin to a particular school of thought, although not all are necessarily linked to a specific etiological theory. This section will be comprised of a critical review of the major treatment methods for CBP so as to develop a rationale for the proposed study and to nest it in a well-established body of research.

The operant approach

As previously mentioned, Fordyce (1976a) and his colleagues formally developed a comprehensive behavioral-oriented procedure for back pain management based upon the application of the principles of learning theory. In review of this treatment model, the major tenet is that suffering can be communication to the environment in the form of pain behavior and this pain behavior can come under

the control of reinforcing consequences in the environment. Fordyce, Fowler, and DeLateur (1968) first demonstrated this approach by the reinforcement of the healthy behavior of a 37 year old female who had 18 years of low back pain. The treatment schedule was devised so that staff attention was contingent upon appropriate physical and non-pain behavior. Results of this schedule demonstrated an increase in activity and the concomitant disappearance of pain complaints. Fordyce, Fowler, Lehmann, and DeLateur (1968) continued this approach with three CBP patients who had multiple surgery and reported positive treatment success. However, pain levels were not reported since they were viewed as unobservables and therefore subject to bias.

In 1973 Fordyce, Fowler, Lehmann, DeLauter, Sand, and Treischman looked at the operant treatment of 36 pain patients, 35 of whom were CBP. At an average of a 22 month follow-up, patients reported continued uptime and reduction in impairment due to pain, but suffered considerable pain problems. Turk et al. (1983) have further scrutinized this study to point out a number of methodological concerns. The length of treatment time amongst patients varied as did follow-up time. Patients were screened before study and the criteria were not reported nor were the characteristics of those excluded reported. Therefore, the 36 patients were a selectively biased population making generalizability difficult. Furthermore, pre- and posttreatment pain reports were both completed after the treatment was concluded,

raising typical concerns of retrospective reporting problems. Finally, no controls were employed, thereby making it difficult to conclude whether the results were a function of operant procedures or occupational/physical therapy or counselling of patients' spouses. In summary, it is difficult to draw definitive conclusions from this research.

Anderson, Cole, Gullickson, Hugheson, and Roberts (1977) also reported on the efficacy of the operant model on patients of the University of Minnesota Hospital. They found that 75% of their sample reported to be leading "normal lives without drugs" following treatment. In this uncontrolled group outcome study, there was no criteria given for defining "normal" and only 19% of the population were really treated. Follow-up was equally as sparse. As well, potential patients excluded from the program were excluded for unknown reasons. The problem with exclusion is that those excluded might typically represent the more chronic back pain population.

Rather than an extensive review of the operant approach (see Trifiletti, 1984; Turk & Flor, 1984; Turk, Meichenbaum & Genest, 1983; Turner & Chapman, 1982b), a few conclusions can be put forth. No control group study has been conducted to test the effectiveness of the operant approach of CBP. In defence of this treatment model, studies do demonstrate a reduction in medication intake, increased activity, and reduction in health care systems use (e.g., Cairns & Pasino, 1977). However, in other studies the removal of feedback and

reinforcement resulted in an immediate return to baseline activity (Cairns & Pasino, 1977). In a study concerned with the reinforcement of exercise behavior it was found that results did not generalize to other exercises outside treatment (Doleys, Crocker, & Patton, 1982). These last two studies raise questions about the long-term effects of treatment conducted in hospital type settings that do not replicate in any form a patient's natural environment (Trifiletti, 1984). Kerns, Turk, and Holzman (1983) suggest operant programs have not paid much attention to issues of generalization of improvement following treatment. As well, operant programs are typically on an in-patient type basis causing not only personal disruption but heavy financial costs.

Further considerations to be mentioned include the premise upon which the operant approach is based, that is that the experience of pain and suffering of the patient are unobservable and therefore not appropriate for direct focus of treatment. However, it appears clinically important to attempt a measure of this presenting problem (variable) in spite of its subjective nature. Pain is a personally perceived experience and it is often that specific problem that brings an individual to seek psychological help. Sanders (1979) has recognized the need of those epousing a behavioral perspective to broaden their scope by incorporating a more multidimensional model of pain and hence an integrative treatment approach. Thus far, the study

and management of cognitive-affective-physiological components is noticeably absent in the operant research in CBP. In summary of the operant approach, Turk & Flor (1984) call for more systematic comparative control group studies in order to evaluate this approach more thoroughly, and to identify for whom this approach is beneficial. Although the research is promising, and credit is due where appropriate, reservations remain.

Biofeedback (EMG) and relaxation

Muscular strain, spasm, and tension are implicated in a number of chronic pain difficulties. In chronic pain problems of the back, muscular activity can contribute to, or be a direct cause of, exacerbating pain perception and maintaining discomfort and pain complaints. Both EMG (electromyography) biofeedback and progressive relaxation have been employed to reduce muscle tension, anxiety, and hence, pain.

There are a number of studies that look at the effectiveness of EMG biofeedback without additional relaxation training. Turk and Flor (1984) acknowledged the difficulty of evaluating these EMG training studies in respect to CBP treatment because of the different methodological procedures used, different patient groups, variations in the number and length of treatment sessions, and numerous design problems all making conclusions tentative. For example, different muscle groups were

targeted (e.g., frontalis versus lumbosacral aponeurosis muscle), sample populations differed (e.g., organic versus functional disease), and measuring procedures varied (e.g., sitting versus movement versus prone position). Most of the studies were uncontrolled, showing reduction in EMG-measured paralumbar muscle activity and reduction in pain intensity (Belar & Cohen, 1979; Freeman, Calsyn, Page, & Halar, 1980; Jones & Wolf, 1980; Keefe, Schapira, Williams, Brown, & Surwit, 1981; Nigl & Fischer-Williams, 1980; Wolf, Nacht, & Kelly, 1982).

In his review of EMG biofeedback studies Trifiletti (1984) noted the inconsistent relationship that exists between EMG activity and pain reports. He also noted the interpersonal process in biofeedback that may provide an opportunity for more intensive exploration of psychological/emotional factors contributing to the pain experience. In one study (Keefe et al., 1981), 14 out of 18 low back pain (LBP) patients showed a decrease in subjective tension but reported no change in daily pain intensity. Of importance in this study is that although pain and the subjective measure of tension were correlated, there was no demonstrated relationship between EMG activity and pain or subjective tension. This puts into question the relationship between muscle strain as a causal factor in the back pain experience. Pain is known to be confounded by other psychological factors such as depression, anxiety, or distress (Gross & Collins, 1981). As Trifiletti (1984)

points out, one interpretation of this study is that psychological strategies designed to deal with anxiety may be a crucial component in pain management procedures.

In a controlled study using EMG training with LBP patients, Nouwen and Solinger (1979) noted that chronic pain patients treated with EMG attained about a 60 per cent reduction in pain intensity and EMG levels in comparison to controls. However, at a three month follow-up EMG ratings returned to initial levels while pain reports further improved. Philip (1977) also reported similar findings as patients' pain complaints reduced after treatment, independent of muscle tension. The conclusion drawn from these studies is that the EMG was useful in assisting to create a change in attitude toward pain (Nouwen & Solinger, 1979). Hence, a sense of self-control, which a CLBP patient typically lacks, rather than actual control of physiological functions may be crucial to a successful pain adjustment process.

In summary of biofeedback EMG training, there exists ample evidence to assume reasonable effectiveness in the treatment of CLBP (Trifiletti, 1984; Turk & Flor, 1984; Turner & Chapman, 1982a) in spite of methodological and research design problems. However, there is little evidence that muscle tension is the underlying mechanism that accounts for a change in pain perception. This is clearly an area requiring further examination.

In relation to relaxation training, without EMG biofeedback, the preliminary results are positive. Two studies indicated that combining the two procedures did not achieve better results than EMG alone (Keefe, Block, Williams, Brown, & Surwit, 1981; Nouwen & Solinger, 1979). Turner (1982) assessed the effectiveness of group progressive muscle relaxation (PMR) training in the treatment of CLBP. PMR was compared to a cognitive-behavioral treatment program and a waiting-list control group. She reported a significant positive effect (in five 90-minute sessions) in pain intensity, depression, and "sickness" adjustment. This trend was also maintained for the duration of a two-year follow-up. In an outpatient treatment study of CLBP, relaxation training was found effective in reducing pain ratings and level of depression (McCauley, Frank, & Cullen, 1983). Both of these studies suggest that because of its easy administration and cost effectiveness, relaxation training in the treatment of CLBP should be more thoroughly assessed as a viable alternative to the more costly EMG biofeedback training or inpatient type operant treatment approach (Turner, 1982).

Hypnosis

The utilization of hypnosis in the treatment of back pain has been well-documented in the past decade (Crasilneck, 1979; Crasilneck & Hall, 1975; Erickson, 1983; Frankel, 1976; Hilgard & Hilgard, 1975; Kroger, 1975; LeHew,

1970; Levit, 1973; Michels, Adams, & McBride, 1983; McCauley, Frank, & Callen, 1983; Sachs, Feuerstein, & Vitale, 1977). Various induction and deepening procedures have been employed, followed by a variety of suggestions:

1. Glove anesthesia--reduce sensitivity in one area of the body not involved in pain (e.g., the hand), denoted by a suggestion of numbness or tingling--"Your hand has no feeling at all." The suggestion then continues as the patient is instructed to place ". . . your hand on the area of pain and feel the numbness flowing from your hand into your back taking away all sensations of pain, tension, and discomfort" (e.g., Barber, Spanos, & Chaves, 1974; Crasilneck, 1979; Gorman, 1979; Hilgard & Hilgard, 1975).

2. Amnesia--tell the person to forget pain by direct suggestion (e.g., Erickson, 1983).

3. Soma techniques--(a) displacement, that is transfering pain to a smaller body area or part; (b) conversion, that is taking accumulated pain in the finger to a nonpainful event, like tingling (Hilgard & Hilgard, 1975); (c) denial, that is the outright denial of that body part after pain transfer; (d) dissociation, that is a person is taught to use guided imagery to leave their ailing body in pain to rest on the bed and take the shoulder, arms, and head to enjoy some activity; and, (e) addition, that is by adding an adjective or adverb to a patient's description of pain automatically alters the client's description of pain, thereby diminishing it (Erickson, 1983).

4. Fantasy, such as age regression--". . . a time when no pain existed, a sense of well-being and control prevailed." Fantasy exercises include imagining positive states and feelings of well-being, as well as the use of an inner advisor, asking the inner advisor to remove pain, even temporarily (Jaffe & Bresler, 1980). Fantasy can also be used as a method of distraction, for example ". . . with a hungry grizzly bear staring you down" (Grindler & Bandler, 1981).

Although the suggestions presented in hypnotic therapy are colourful and research in the area appears promising with positive results, for the most part, clinical research studies are uncontrolled with a subjective pain report being the main criterion of success, with a few exceptions (e.g., Sachs et al., 1977). As Turk and Flor (1984) point out, hypnosis as a treatment mode has been applied longer than any other treatment mode which makes the lack of controlled data distressing. Turner and Chapman (1982b) explicate the opinion that ". . . until controlled research demonstrates otherwise, we are forced to take a position of skepticism toward the clinical lore that hypnosis is a powerful method of chronic pain alleviation" (p. 30).

Cognitive-behavioral approach

The cognitive-behavioral view is a conceptual extension of or relation to Melzack and Wall's (1982) multidimensional view of pain. Hence, a treatment approach would incorporate

sensory, affective, and cognitive-behavioral components. The goal of this treatment approach is to alter malfunctional thoughts, feelings, and behaviors and therefore the sensory experience of pain. As such a program is comprehensive, it borrows techniques from a variety of areas, including those treatment modes aforementioned. A cognitive-behavioral treatment approach would incorporate: (a) an educational component regarding pain; (b) the identification of pain eliciting stimuli; (c) stress management; (d) modification of dysfunctional thought; (e) skill teaching for relaxation via imagery, deep breathing, distraction; (f) goal setting; and (g) increased activity (Turk, Meichenbaum & Genest, 1983). It is evident that many of the strategies used in a cognitive-behavioral treatment regimen are from one of the aforementioned treatment approaches or another, leading Turk et al. (1983) to conclude that all forms of therapy for chronic pain are cognitive-behaviorally based.

As mentioned in a previous section, Turner's (1982) study also incorporated a cognitive-behavioral treatment approach as one of the conditions and results indicated pre-post improvement in pain intensity, depression, and sickness profile. Gottlieb, Strite, Koller, Madorsky, Hockersmith, Kleeman, and Wagner (1977) noted that in their comprehensive program, which included positive self-talk, relaxation, education, etc., 79% of their patients showed impairment-free physical functioning at discharge followed by a one month vocational rehabilitation rate of 95%.

Results of their efforts are especially promising as their subject pool comprised of long-term CLBP patients. However, as Turk and Flor (1984) point out, no pain measures or other subjective indices were taken nor were physiological parameters documented. Furthermore, when a similar cognitive-behavioral approach was used in a group comparison outpatient format to physical therapy, the results were not as promising (Cohen, Heinrich, Collins, & Bonebakker, 1980, cited in Turk & Flor, 1984).

In summary of the cognitive-behavioral view, it appears that cognitive-behavioral programs can be applied to outpatient and group settings and is therefore cost effective as well as has demonstrated some effectiveness in the area of chronic low back pain. However, more research is again needed before the efficacy of this approach can be evaluated.

Summary of treatment approaches

The treatment of CLBP by psychological intervention is a relatively new and promising endeavour. A variety of studies via different treatment orientations have reported pain reduction, less muscle tension, decreased medication, reduced depression, and an increase in uptime activity and employability. However, one cannot be purblind to the fact that most of the research in the psychological treatment of CLBP is difficult to scientifically grade because of the lack of controlled study design and follow-up. Furthermore,

comparison of various treatment approaches is difficult as each treatment aspires to its own success criterion (e.g., EMG--muscle relaxation; hypnosis--self-report of pain reduction). As a final comment, further research is required comparing the effectiveness not only between treatment modalities but also within treatment modalities (e.g., such as variations within a cognitive-behavioral program).

G. The Common Component: Relaxation

In all of the previously discussed treatment modes, with the exception of the strict operant approach, relaxation techniques have been employed as an integral part of the therapeutic process. As relaxation procedures do constitute a major component of psychological treatment for pain, it should be evaluated as to its effectiveness in the reduction of chronic pain. It has been well noted that the evaluation of relaxation training for CLBP has been addressed only minimally (Turner, 1982; Turk & Flor, 1984), and typically in conjunction with other treatment procedures (e.g., cognitive-behavioral treatments) or as an accepted by-product (e.g., hypnosis).

Relaxation, that is the act or fact of being relaxed (Wester, 1986), has a number of physiological correlates. The relaxation response is a trophotropic zone response (Benson, Beary, & Carol, 1974). The trophotropic zone is located in the anterior area of the hypothalamus. This response is mediated by the parasympathetic nervous system

and electrical stimulation of this zone results in adynamia of skeletal musculature, decreased blood pressure, decreased respiratory rate, and pupil constriction. These adynamic effects are opposed to ergotrophic reactions which are oriented toward an increased oxidative metabolic rate and utilization of energy. The relaxation response, therefore, is a counterpart to the fight or flight response proposed by W. Cannon, that is, the natural sympathetic response to stressful situations.

For decades researchers have suspected the link between stress and physical illness (e.g., coronary heart disease). Chronic psychosocial stress is the companion of twentieth century humanity as our obsolete bodies attempt to cope with the chronic anxieties of modern life. Anxiety is a central tenet of many theories of psychopathology (e.g., severe phobic reactions) and a wise clinician must acknowledge the presence of anxiety if any type of therapy is to succeed. It is not surprising that relaxation therapy is often one form of treatment for severe anxiety reactions (e.g., Farmer & Wright, 1971; Lader & Mathews, 1968; Paul, 1969). As it has been already established that anxiety often accompanies CLBP syndrome, a justification for the use of relaxation therapy exists in respect to this known factor.

Other factors also warrant the use of relaxation for CLBP patients. Since the primary purpose of relaxation is to elicit parasympathetic activity, and thereby a marked reduction in muscle tension, relaxation therapy is warranted

for the treatment of CLBP as muscle tension is one culprit implicated in the genesis or exacerbation of back pain. Although published reports have demonstrated the pain-relieving effectiveness of relaxation therapy, a majority of those studies focused primarily on the reduction of tension headache frequency, as reviewed by Turner and Chapman (1982a); only a few attempts have begun to look at the efficacy of relaxation training for CLBP.

Lastly, depression has been clearly implicated as affecting chronic pain and pain behavior (Keefe, Wilkins, Cook, Crisson, & Muhlbaier, 1986), and it therefore contributes to a CLBP syndrome composite. Although relaxation training is nonspecific to the major psychological theories of depression, it has been identified as an effective treatment for the reduction of symptomatology associated with depression (e.g., Biglan & Dow, 1984). In one therapy outcome study, relaxation training was found to be as effective as psychotherapy and pharmacotherapy in the treatment of depression (McLean & Hakstian, 1979). As well, relaxation training has been incorporated into a number of successful treatment packages for depression (Zeiss, Lewinsohn, & Munoz, 1979). Again, since depression is highly correlated to CLBP, it is logical that relaxation training would be most logical for the treatment of CLBP sufferers.

In summary, the rationale for the use of relaxation training in the treatment of CLBP lies on well established

empirical research that indicates relaxation training reduces anxiety, depression, and pain. Anxiety, depression, and pain are intricately linked, forming a convoluted figure that embraces the phenomenon of CLBP. Although relaxation training is clearly suited to those suffering from CLBP, not enough research has been initiated to address the effectiveness of relaxation training for the treatment of CLBP.

H. Imagery: The Vital Component?

In the previous review of psychological approaches to the treatment of chronic back pain, it was found that relaxation techniques were employed in hypnosis, utilized in conjunction with biofeedback and also as a part of skill development in the cognitive-behavioral repertoire. Often a relaxation exercise incorporates the use of imagery to induce a deeper state of relaxation.

Imagery may be defined as those quasi-sensory or quasi-perceptual experiences of which one is self-consciously aware and which exists in the absence of those stimulus conditions that are known to produce their genuine sensory or perceptual counterparts (Richardson, 1969, cited in Sheikh & Jordan, 1983). The history of psychology is replete with the utilization of imagery. For example, both Freud and Jung were aware of the use of imagery in a therapeutic context (Sheikh & Jordan, 1983). Freud's technique involved pressing on the patient's head

and upon release a request was made to the client to observe the images that would appear. It was Freud's contention that the patient would see a rapid succession of scenes related to internal conflicts. The point of therapy was to wipe away those scenes. Jung, on the other hand, saw the unconscious as a state of constant dreaming. He felt that as an individual's attention became focused on the outside world, he or she became unaware of the imaginal world within unless brought into consciousness. Jung proposed that the use of an active imagination and the relating of that material to one's own life gave an individual an advantage in breaking a humiliating dependence.

The European utilization of imagery did not find expression in North American psychology for a great number of years as both the emergence of behaviorism in the 1920's and the North American psychology moratorium on inner experience was in full effect. As Sheikh and Jordan (1983) point out, not a single book on this topic was published from 1920 to about 1960. However imagery, the ostracized ghost (Holt, 1964), was slowly reinstated in mainstream psychology, and oddly enough this redemption was aided by a behavioral treatment format known as systematic desensitization (Wolpe, 1958). Imagery has now been incorporated into Meichenbaum and Turk's (1976) stress inoculation program, a cognitive-behavioral treatment schedule for pain. It is their hope that by eliciting affect-arousing imagery situations, the

motivational-affective dimension of pain (Melzack, 1973) might be altered thereby reducing the experience of pain.

Imagery has the power to produce a wide variety of physiological changes. Barber, Chauncey, and Winer (1964) asked their experimental subjects to imagine drinking sour tap water and increased salivation was the noted change. May and Johnson (1973) were able to change heart rate by internally-elicited arousal. Barber (1961, 1969, 1978) utilized imagery to produce blood glucose increases, the inhibition of gastrointestinal activity, increased gastric-acid secretion, blister formation, etc. Sheikh, Richardson, and Moleski (1979) noted that when meditation and biofeedback involved the use of imagery it could result in a decrease in blood pressure, oxygen consumption, and heart rate. Neal Miller (1972, cited in Sheikh & Jordan, 1983) has remarked that imagery might be the only practical way to develop control of the autonomic nervous system.

General research in the area of pain management has shown that the use of imagery can be effective in the relief of pain. However, most of the research concerns itself with pain induced during experimental laboratory sessions (e.g., Beers & Karoly, 1979; Chaves & Barber, 1976; Horan, Hackett, Buchanan, Stone, & Demchuk-Stone, 1977; Spanos, Brown, Jones, & Horner, 1981; Weisenberg, 1977; Worthington, 1978) and only a few studies have examined the effectiveness in a clinical population (Brown, 1984; Raft, Smith, & Warren, 1986). No studies in the use of imagery with respect to CLBP

have been found by this author to date. The efficacy of imagery in the management of pain has not been universally endorsed in the literature. Greene and Reyher (1972) found that analgesia produced by hypnotic suggestion was more effective in increasing pain tolerance than in combination with imagery. Weisenberg (1977), in commenting on the above study, cautions that these results warn against one assuming that pleasant imagery will automatically always reduce pain.

In a recent study Raft, Smith, and Warren (1986) compared the use of imagery in the pain relief of both chronic and acute pain populations. Research indicated that images selected by the patient and chosen by the therapist were effective in the treatment of pain; however, the effectiveness became less evident on each successive day for the chronic group. The strength of this study is that it addresses a number of issues not previously dealt with in pain research. It is only one of a few studies to look at the effectiveness of imagery procedures with the clinical population. Secondly, it presents evidence supporting the notion that pleasant imagery can reduce pain, and that the effects might be greater for acute than chronic pain populations. As a final note, the authors suggest that future research into pain reduction techniques, such as imagery, should continue in respect to both acute and chronic pain sufferers, as each appears a separate clinical entity.

In conclusion, research thus far has been promising in respect to pain reduction by use of imagery. However, as imagery therapy is often used in conjunction with or following relaxation training, research as to the causal agent in actual pain reduction has not addressed the relaxation/imagery distinction. Research into suggestibility responses purports that a combined approach (i.e., relaxation and imagery) is the more powerful approach in enhancing a person's willingness to accept and act upon given suggestions (Mitchell & Lundy, 1986). To date, no systematic attempt has been made to isolate imagery or relaxation components or combine them in respect to pain treatment for a CLBP population.

III. Statement of Problem

Back pain is one of the most prevalent and costly health problems in North America. In spite of the magnitude of chronic back pain, amazingly little is known about the causes and hence, effective treatment (Flor & Turk, 1984; Turk & Flor, 1984). The ineffectiveness of medical treatment combined with the lack of discernable organic pathology for chronic back pain has prompted a multidisciplinary approach to the study and treatment of CBP. Psychological treatment approaches to CBP syndrome include: (a) operant treatment (Fordyce, 1976); (b) respondent treatment (e.g., EMG biofeedback); (c) cognitive-behavioral approaches (e.g., Turk, Meichenbaum, & Genest, 1983); and (d) hypnosis (e.g., Hilgard & Hilgard, 1975).

Research into the effective treatment of CLBP by psychological intervention is promising; however, there exist a number of flaws or gaps that make effectiveness conclusions difficult (see Turk & Flor, 1984). The majority of studies have failed to adequately describe their treatment population, and many subjects were excluded or removed from treatment for unknown reasons. Perhaps it was these excluded patients that are more typical of CLBP patients. As well, most studies chose to look at pain control, reduction or tolerance with experimentally induced pain. Few studies addressed the clinical "hard core," chronic back pain patient population. There were also some methodological issues that warrant concern. A majority of

studies had failed to incorporate a waiting-list or placebo control group. In some studies and treatment approaches, pain reduction was not even addressed. In other studies, measurement procedures did not include the use of standardized psychological tests to measure pre- and posttest differences. Finally, few studies included a follow-up component.

Another gap identified by the author is that although relaxation procedures are incorporated into a number of treatment approaches, few studies have addressed the efficacy of relaxation in the treatment of CLBP. Only two known articles have commented on the efficacy of this treatment in the management of CLBP (McCauley, Frank, & Callen, 1983; Turner, 1982), and both studies dealt with an outpatient population. Results of these studies proved positive, prompting the contention that because relaxation training is easy to administer and cost effective, it should be more carefully assessed. As this treatment modality is an integral part of certain management procedures of CLBP, it becomes incumbent on researchers to scientifically scrutinize this form of treatment more closely. As relaxation training can take many forms and often includes the use of imagery, the use of imagery in relaxation procedures for CLBP patients should also be addressed. The use of imagery in the medical setting is just beginning to be evaluated (e.g., Jaffe & Bresler, 1980). Although a lot of research in the area of psychological treatment for CLBP

has been conducted, the opportunity for further research clearly exists as this field is relatively new and the research to date reflects this state.

A. Purpose of the Study

The purpose of this study is to evaluate the efficacy and utility of group relaxation procedures in the management of CLBP. Very few studies have addressed this often used treatment form in respect to CLBP management. Since relaxation procedures often incorporate the use of imagery, the study examines variations of relaxation procedures with and without imagery, and imagery alone in an attempt to determine the "active ingredient" that might best attenuate pain and restore psychological health (e.g., depression and anxiety).

The study examines the efficacy of relaxation and imagery in the treatment of a clinical chronic back pain patient population. This study attempts to rectify shortcomings identified in previous CLBP psychological intervention studies by: (a) working with a chronic low back pain patient population presently attending an outpatient treatment centre and while being on Workers' Compensation benefits; (b) incorporating a psychoeducational comparison group; (c) making a 2 month follow-up with all those involved in the research procedures; (d) making use of standardized psychological tests; (e) addressing areas germane to a chronic pain patient's psychological health:

depression, anxiety, and a subjective pain report; and (f) making pre- and posttest measures to evaluate the effectiveness of the treatment procedure. It is hoped that this study addresses the gaps identified in the CLBP literature and will therefore lend utile information to the practising health care clinician.

IV. Method

A. Subjects

All 84 male patients who participated in the research study were randomly selected from a chronic low back pain population of the Alberta's Workers' Compensation Board Rehabilitation Centre in Edmonton, Canada. The selection from a pool of potential subjects occurred in 3 waves: summer and fall of 1987; and winter of 1987/1988. The Centre receives ongoing outpatient referrals (approximately 1300 patients yearly) from consulting physicians in the community who are involved with compensation claimants. Because the Centres' patient population is primarily male, the study was limited to males to assure homogeneity of groups. Referrals to the Centre are premised on the fact that patients had previously undergone a series of medical treatments in the community with no appreciable relief. Criteria for inclusion into the study included: (a) males between 18 and 65 years of age; (b) a current documented episode of low back pain for at least 6 months; (c) no concomitant psychological treatment; and (d) no previous psychological intervention for chronic pain. All of the above were confirmed by reviewing the compensation documents of each patient and via a questionnaire given to each participant prior to their involvement in the study.

B. Therapist

Treatment of all four experimental groups was conducted by the author, a doctoral-level counselling psychology graduate student. Both for pragmatic reasons and to control for such variables as therapist personality, theoretical orientation and style one therapist was used. The therapist was aware of experimental bias that could be introduced by variations in his behaviour. Consequently strict adherence to passive treatment protocols (i.e., educational information) and formatted active treatment protocols (i.e., relaxation and/or imagery scripts) was observed. Prior to the onset of the study, examples of the relaxation and/or imagery scripts were videotaped by the therapist for review by three senior level psychologists to ensure competence on the therapist's part to provide distinct active treatment scripts.

C. Design

The study consisted of three active treatment conditions (relaxation therapy, imagery therapy, relaxation and imagery therapy) and a comparative psychoeducational treatment condition delivered in the context of a preplanned orthogonal contrast design, using difference scores on the dependent measures. All subjects were tested at two times: pretreatment assessment (including informed consent; see Appendix A) and posttreatment assessment. The pretreatment assessment was conducted 3 days before the start of the

first session, and the posttreatment testing was conducted immediately after the final treatment session. A follow-up assessment was conducted on the active treatment groups 8 weeks later.

D. Dependent Measures

Depression. The Beck Depression Inventory (Beck, 1972) was used as a self-report measure of depression. The Beck Depression Inventory (BDI) has been viewed as one of the better self-report measures of depression among clinical and nonclinical populations and has become a widely used measure in clinical research. This inventory consists of 21 items to reflect a variety of cognitive, somatic and overt motoric symptoms of depression. The internal consistency reliability is reported to be .85 and the BDI is correlated significantly as well with the Zung Self-Rating Depression Scale and the University of Los Angeles Loneliness Scale (Reynolds & Gould, 1981). Beck (1972) reported that a concurrent validity check with other measures of depression yielded significant correlations. He reported a correlation of .66 between the BDI and the Depressive Adjective Check List and a .75 correlation between the BDI and MMPI D-scale. The reliability and validity of this inventory as a measure of general depression severity has been supported by a number of studies (Rehm, 1976), including those with the chronic pain population (Turner & Romano, 1984). In any situation where a screening device is necessary for

depression, the BDI would be the best chosen test (Stenhouwer, 1985).

Anxiety. The State-Trait Anxiety Inventory (STAI) (Spielberger, 1983), Form X1 and Y1 were alternately used as a self-report measure of anxiety. The STAI is reportedly one of the most researched and one of the best standardized measures of anxiety (Dreger, 1978). Since change in anxiety is one of the dependent measures of the study, only the state anxiety portion of the test was administered. State-anxiety refers to anxiety which a person experiences in response to certain specific conditions. The internal consistency of the State-anxiety scale is in the range from .86 to .95. The stability coefficients for the State-anxiety scale ranged from .16 to .62. This low level of stability is expected since responses to items on this scale are thought to reflect transient situational factors that influence the individual at the time of testing (Chaplin, 1985). Furthermore, construct validity for the State-anxiety scale can discriminate between military recruits who are beginning a stressful training program and high school students (Spielberger, 1983). One possible disclaimer of the State-scale is that its high level of face validity may make it easy to fake. On the other hand, the proliferation of the use of the STAI in research, easy-administration, easy-to-score, reliability, and validity suggest that this test is the most suitable for the present research purpose.

Pain Severity Scale. All patients were asked to monitor their pain level for three consecutive days, 3 times per day (a.m., p.m. and evening) prior to treatment and immediately following the last session. The instrument used to monitor pain was an altered 0-10 visual analogue scale (VAS) with semantic reference points (e.g., 4 = Aware of back pain most of the time, but still able to concentrate on easy tasks; see appendix C). This altered visual analogue scale was included as the pain measure of choice as it was easy to administer and maximized patient monitoring compliance by requiring little time and effort to complete. Semantic markers were added to the typical visual analogue scale (e.g., Scott & Huskisson, 1976) to address concerns regarding the use of the scale, such as its sensitivity (Gracely, 1979). Scott and Huskisson (1979) noted that people were unable to reproduce VAS scores and tended to overestimate pain-intensity when their initial VAS rating was unavailable to them. It has been suggested that reproduction errors may be due to patients marking what they ought to feel rather than what they actually experience (Dixon & Bird, 1981). By adding a semantic marker which is a behaviour related reference point it is hoped that the patient will more accurately rate their pain as it relates to their present functional behaviour and that this accuracy will also operate at posttesting, thereby making for a more reliable and sensitive monitoring device. The use of behavioural reference points is also justifiable as they

pertain to the functional ability of a patient to perform tasks, which reflects the essence of their being on a compensation claim, that is their present level of functioning (or dysfunction) that makes them unable to work.

Pretreatment Questionnaire. This questionnaire was used to cross check with compensation records criteria for inclusion into the research program as well as gather general and demographic information as it pertained to the research. Information gathered included: number of back operations; medications presently in use; marital status; educational information; type of work and the physical activity level of the preaccident employment; duration of back problem; outcome expectancy; etc. (see Appendix B). Research participants also monitored the time they spent concurrently in other therapy programs (e.g., physical therapy) at the Centre while attending psychologically oriented therapy (see Appendix D).

Post-treatment Manipulation Check. To ensure that treatment outcomes were the result of a specific form of treatment, an independent manipulation check measure was given to each subject along with the dependent measures following a two-week treatment program (see Appendix E). The purpose of this measure was to ascertain whether the subjects' perception of the treatment was consistent with what the experimenter thought he was teaching to subjects in each of the three treatment conditions.

Course Evaluation/Follow-Up Questionnaires. Following the completion of a treatment period each patient filled out a course evaluation to ascertain their perceived benefits of attending the program. This measure consisted of 8 items and uses a 4 point Likert-type response format (0-3), with a higher score reflecting a greater degree of agreement to a given statement (e.g., "I now understand the nature of pain better."). Areas assessed by this measure included: pain knowledge, ability to control worry, back pain control, back management, increased positive feelings, etc. (see Appendix F).

The telephone follow-up measure consisted of 13 items and also uses a similar 4 point (0-3) Likert-type response format. Areas assessed by this measure include: self-worth, sleep, social relations, pain control, decrease in medication use, continued practice of skills taught, more positive attitude, etc. (see Appendix G).

E. Materials

All four groups received treatments in a group room which comprised of 13 reclining chairs, with the optional use of pillows for back support if required. Hard chairs were also provided as an option to those in the groups who could not sit in the softer recliners. Floor mats were another option provided for those who would rather lay down during the active portion of the treatment (i.e., relaxation and/or imagery). Lectures were presented by the therapist at

the front of the room, with the use of a podium for lecture materials and a black board to highlight points of emphasis. The room was also equipped with the use of a video/television system. The room's lighting system was operated by a dimmer switch which was used to dim the light in the room during the active portion of the treatment so as to prevent visual distraction interfering with the patients' efforts to utilize the taught techniques.

F. Assignment Procedures/Attrition

All participants of the CLBP study were randomly selected from a potential chronic low back pain subject pool (by method of a random numbers table) and then assigned randomly to one of four groups, to minimize unwanted sources of variance. Treatment interventions were then assigned to each of the groups. When all four treatment groups had run completely once, this procedure was repeated. The number of patients per group varied from 7 to 13 during any one treatment session. On three occasions the researcher had to return to the potential subject pool to solicit voluntary participants based upon the fact that some randomly selected patients could not participate for the full length of the treatment time (determined prior to the onset of the treatment program). In order to assure a minimum number of participants in the group (seven), additional participants were sequentially selected on three occasions. Sequential selection does not compromise randomness (Kirkpatrick &

Aleamoni, 1983).

During actual treatment sessions, 9 people dropped out or were not used in the final analysis: 2 in the relaxation group, 4 in the imagery group, 3 in the relaxation and imagery group and 1 in the psychoeducational group. Three of the individuals who dropped out ran into treatment schedule problems and it was determined that physical interventions were more appropriate than psychological intervention. Four individuals were not used in the final analysis because 3 of them were absent during the treatment sessions reducing their attendance below 80% of the sessions, and one did not meet the duration of the present pain criteria of 6 months. Two individuals (1 in each of the relaxation and imagery groups) quit early during the treatment program exercising their right as indicated on the informed consent. Both individuals indicated that they felt the treatment would probably not help them so they preferred not to attend. Lastly, following the accumulation of all research data one set of subject data from each of the relaxation and psychoeducational treatment groups was randomly dropped from the final analysis to make each of the groups equal in cell size to simplify analysis. It is felt that the overall mortality rate, including natural and planned attrition, is experiment-wise low and should not effect the internal validity of the study.

G. Treatments

Elements common to all treatment conditions. As previously mentioned patients who met the subject-inclusion criteria were randomly selected and assigned to groups and treatments to groups. The four group interventions were the active treatment groups, namely Relaxation Training (R), Imagery Training (I), Relaxation and Imagery mixed (M), and the passive treatment group, a Psychoeducational group (P). A pretreatment assessment was performed on all research participants 3 days prior to the onset of treatment and included: a general introduction about the service to be provided within the rehabilitation context; an explanation regarding research participation; thorough understanding of informed consent; and the administration of the dependent measures - BDI, STAI-state and altered pain visual-analogue scale (VAS). The VAS was a three day, three times per day scale that was to be completed prior to group treatment participation. The posttreatment assessment included the administration of the dependent measures and a course evaluation. The follow-up questionnaire was administered by telephone to the three active treatment groups: R, I and M. All pre- and post-test measures were administered by senior level psychologists who volunteered their time for the study. The telephone follow-up questionnaire was administered by a research assistant who was a university graduate, specialization in psychology. All people involved in the pre-post measures and follow-up questionnaire were

provided with a protocol for guidance, to standardize the procedure.

Subjects of the active treatment groups were seen for a total of 8 days one-and-a-quarter hours each day over a two week period of time. The typical daily programme regimen included: attendance taking, an update by patients as to time spent in the previous 24 hours in other treatment modalities at the Centre, a lecture portion accounting for the first 40 minutes of a session and a thirty-minute training exercise (e.g., relaxation training). The psychoeducational group only received the same amount of lecture time, but did not get involved in any independently manipulated treatment (e.g., imagery training). All groups were encouraged to discuss issues raised by lectures presented.

Chronic Back Pain Lectures. All four groups participated in the lecture portion of the study (passive treatment) which was coined by the author as the "Back on Track" program for chronic back pain sufferers.

Session 1 began with a general introduction into the program. In this session the outline of the groups was provided with a statement of the philosophy of the program and a rationale particular to each of the respective treatment groups given. The gist of the program's philosophy was that individuals all have a capacity to learn important things about their back condition and themselves and that this understanding can lead to effective ways of learning to

cope with their chronic back problem and reinstate a quality of life that they are again accepting of. The A B C's of the program were discussed (e.g., A = Accepting our situation; B = Building on our resources; and, C = Change and commitment required for any success in low back pain management) with an appeal to each research participant to make a commitment to themselves to begin an adjustment process to the best of their ability.

Session 2 began with a review of the previous day's discussion and then the presentation of a video-taped television documentary on chronic pain (Body Watch, WBGH-Boston, 1986). The purpose of the videotape was to bring into perspective the many common problems faced by people who suffer from all kinds of chronic pain conditions. This film was used as an illustrative reference throughout the program.

Session 3 began with a review of the videotape presented on the previous day and an introduction to pain. The lecture included a definition of pain, the function of pain as an alarm system, its elusive scientific qualities (e.g., measurement), cultural differences in the pain experience, etc.

Session 4 was a review of good pain (acute) and bad pain (chronic) via the use of two case vignettes to highlight this distinction in a number of areas: the value of pain as it pertains to survival, change in daily activities, environmental changes, changes in social, work

and family roles, perception of medical care and some emotional consequences (e.g., anger).

Sessions 5 and 6 looked at pain as a function of memories, motivations, nerve signals and emotions. All subjects were asked to place their own pain experience or pain reactions within the context of their past, such as how they were taught to handle pain or how other family members dealt with pain. Motivations were presented by requesting that each subject become honest with themselves and examine if they were experiencing any payoffs for their present state (e.g., keeping concerns about a marital disagreement in the distance). The nerve signals portion of the lecture was comprised of a brief simple review of the physiology of pain and an introduction to the gate-theory of pain.

Session 7 focused on the emotional consequences of chronic low back pain. A chronic pain emotional reaction was explained within the typical stages of grief reactions (denial, anger, bargaining, depression and acceptance). Anger and depression were the primary areas of discussion that were related to maladaptive belief systems and as a reactive consequence to the loss sustained by the compensation claimant in many areas of life (e.g., employment, social, etc.).

Session 8 consisted of the relationship between medication, sleep and the chronic pain experience. With respect to medication, patients were provided with an understanding of the consequences of long term medication

intake and the dangers of becoming physically and psychologically dependent to an intervention that is unidimensional in nature. Subjects were also educated about the function of sleep and its importance in effective pain management. Complications to effective sleeping patterns in CLBP patients include movement in sleep and spontaneous awakenings, natural events that may serve to allow the patients to focus on pain and thereby prevent sleep. At the end of session eight a research assistant came in to administer the posttreatment measures and course evaluation. The VAS was to be returned to the researcher after 3 consecutive days of pain monitoring posttreatment.

Relaxation-Training Group. Patients in this group were taught progressive-muscle relaxation type skills (PMR) as described by Bernstein and Borkovec (1973). This approach was modified and stripped of imagery for these research purposes (see Appendix H). The rationale provided for the use of relaxation training in the treatment of chronic low back pain was for the patient to appreciate the relationship between pain, muscle tension, and depression and to learn specific skills to facilitate self-relaxation.

Imagery-Training Group. Patients in this group were taught imagery techniques via a semi-guided fantasy technique. This technique was stripped of suggestions of relaxation and/or sleep (see Appendix I). The rationale provided for the use of imagery was to appeal to the known powers of imagery to affect the way people feel emotionally

and physically, and how this may impact upon chronic pain sufferers who experience the emotional consequences of long term pain and disability. Subjects were given examples of how by visual imagery, people have a demonstrated ability to directly affect physiological processes (e.g., heart rate and hand temperature) and how these same powers may be utilized for the purposes of reducing the subjective emotional and physical (sensory) experience of pain. All subjects were asked prior to the actual imagery exercises to create a picture, a sound, a colour, a shape or object that best represented their unique, personal experience of back pain and to write this image down on a piece of paper for future use. They were also asked to think of a way to alter this representation with the purpose of possibly changing their personal experience of pain. All subjects were requested, on a voluntary basis, to hand in their personal image of pain to the researcher (see Appendix J).

Relaxation and Imagery-Training Group. This combined treatment procedure utilized PMR-like skills in combination with the aforementioned imaginal skills for deepened training. All subjects were also requested, on a voluntary basis, to hand in their personal image of pain to the researcher (see Appendices J & K).

Psychoeducational Group. This group was not involved in the active treatment portion.

H. Data Analysis

The primary method of analysis undertaken is a pre-planned orthogonal contrast (Ferguson, 1976; Keppel, 1973) proposed because of theoretical and methodological considerations. Orthogonal comparisons will be made on the difference scores of pre- and posttest measures of the dependent variables: pain (a.m., p.m., and evening), depression (BDI), and anxiety (STAI-state). Because the author was concerned with questions of specific research interest or experimental meaning, comparisons were constructed (pre-planned) to represent an efficient breakdown of the results of the research so that each comparison of interest is independent and nonredundant. Orthogonal comparisons represent uncorrelated pieces of information (Keppel, 1973), meaning that the independence assumed refers to the information used in each set of comparisons and not to the statistical tests themselves. However given a sufficient number of degrees of freedom within the design of research this poses no practical problem (Keppel, 1973).

The proposed comparisons (K-1) for all four groups, Relaxation (R), Imagery (I), Relaxation and Imagery (M) and the Psychoeducational (P) are, respectively, as follows: Contrast 1: -1 -1 -1 3; Contrast 2: 0 -1 1 0; Contrast 3: 2 -1 -1 0. Using the standard method for determining whether a comparison is acceptable and orthogonal, one can readily see that the above contrasts fulfill the criteria. The first

contrast will be to compare all active treatments to the passive treatment psychoeducational group. The second contrast will be to compare imagery to relaxation with imagery. The final comparison will compare treatments without imagery to treatments with imagery as a component. Computations for all analyses were completed utilizing the SPSSX (1986) statistical software package.

Additionally one-way ANOVAs were performed on all pretreatment data to verify that groups were equated by the random assignment with additional required comparisons utilizing the post-hoc Newman-Keuls pairwise range test. A Chi-Square analysis was performed on all nominal scale demographic data. Pearson product moment correlations were computed to examine the relationships, if any, between the following: age, duration of accident claim injury, duration of back problems, outcome expectancy, and the pre/post/difference results on each of the dependent measures (BDI, VAS, STAI-state). The following chapter will present the results of the data analysis.

V. Results

This evaluation focuses on three major constructs which are believed to be modifiable as a result of participation in a psychological treatment program designed for chronic low back pain sufferers. Pain, depression and state-anxiety instruments recorded pre- and posttreatment measures for 84 subjects in the research study randomly assigned into four equal groups of 21 subjects per treatment condition. The equality of groups, and subsequent accumulated data were statistically analyzed as described in the previous chapter to answer research questions that dictated the design of the study. The philosophy of this research endeavour was to assess the degree to which people who suffer from chronic low back pain changed on various dependent measures, therefore, difference scores (*D*) were analyzed (posttest minus pretest scores) within an orthogonal contrast design. As evident in the a priori contrasts, it is the author's contention that significant effects on all dependent measures will conclude that: all active treatment groups will do better than the psychoeducational group; that the combined relaxation and imagery group will do better than imagery alone; and that treatments with imagery will be more effective than treatments without imagery.

A. Equality Among Groups

To determine the degree to which the random assignment procedures created equivalent groups, all four treatment groups were compared on different demographic and research variables of interest. The means, standard deviations and frequencies (%) of each demographic variable are presented in Table 1. One-way ANOVAs and Chi-Square analyses used where appropriate, determined group equality on all variables. As well, Cochran's C test (Kirk, 1968) was used to determine the homogeneity of variance and no significant evidence was found to support heterogeneity of variance. In the analysis of concomitant therapy (e.g., occupational therapy) undertaken by research subjects in the rehabilitation centre, a significant difference was found in the imagery group (I) $F(3,80) = 4.95$, $p = .003$ ($X = 11.26$, $SD = 5.04$) having received more physical therapy than the relaxation (R) ($X = 6.63$, $SD = 4.33$), relaxation + imagery (M) ($X = 6.98$, $SD = 4.36$) or psychoeducational (P) ($X = 8.95$, $SD = 3.72$) groups (see Table 2).

B. Manipulation Check

One-way ANOVAs and Newman-Keuls performed on all manipulation check questions revealed significant group differences in endorsing relaxation and/or imagery as the intervention technique taught to them (see Table 3). On the relaxation skills check a significant difference was found $F(3,80) = 69.63$, $p < .000$, with the relaxation ($X = 2.71$, SD

Table 1 Demographic Information

Variables	R[1] (N=21)	I[2] (N=21)	M[3] (N=21)	P[4] (N=21)
Age (mean yrs)	40.19	38.71	39.67	35.47
S.D.	9.92	11.03	8.85	10.79
Duration of accident (yrs)	1.37	1.22	1.78	2.90
S.D.	1.59	1.32	1.49	5.79
Duration of back problem (yrs)	5.36	5.02	5.26	5.09
S.D.	7.93	6.62	7.14	6.97
Marital Status (%)				
Single	3 (14.3)	3 (14.3)	3 (14.3)	3 (14.3)
Married or C/L	16 (76.2)	15 (71.4)	13 (61.9)	15 (71.4)
Separated or Divorced	2 (9.5)	3 (14.3)	5 (23.8)	3 (14.3)
Education (%)				
Less than high school	7 (33.3)	6 (28.6)	6 (28.6)	8 (38.1)
Some high school	7 (33.3)	13 (61.9)	11 (52.4)	9 (42.9)
High school grad.	4 (19.0)	2 (9.5)	2 (9.5)	3 (14.3)
Partial Univ. or Tech.	2 (9.5)	0 -	1 (4.8)	0 -
Grad Technical	1 (4.8)	0 -	0 -	1 (4.8)
Grad University	0 -	0 -	0 -	0 -
Type of work (%)				
Labor-unskill/semi-skilled	14 (66.7)	13 (61.9)	16 (76.2)	18 (85.7)
Skilled	6 (28.6)	8 (38.1)	5 (23.8)	3 (13.6)
Clerical/Office	0 -	0 -	0 -	0 -
Professional/Technical	1 (4.8)	0 -	0 -	0 -
Physical Activity Level (%)				
Sedentary	0 -	0 -	1 (4.8)	0 -
Light	1 (4.8)	1 (4.8)	0 -	2 (9.5)
Medium	17 (81.0)	13 (61.9)	14 (66.7)	11 (52.4)
Heavy	3 (14.3)	7 (33.3)	6 (28.6)	8 (38.1)
Very Heavy	0 -	0 -	0 -	0 -
Medications (%)				
Yes	17 (81.0)	16 (76.2)	17 (81.0)	14 (66.7)
No	4 (19.0)	5 (23.8)	4 (19.0)	7 (33.3)
Type of Medication (%)				
Anti-depressant	1 (5.9)	0 -	0 -	1 (7.1)
Anti-inflammatory	5 (29.4)	4 (25.0)	4 (23.5)	2 (14.3)
Analgesic	11 (64.7)	7 (43.8)	10 (58.8)	11 (78.6)
Anxiolytic	0 -	2 (12.5)	0 -	0 -
Muscle Relaxant	0 -	3 (18.8)	3 (17.6)	0 -
Diagnostic Evidance (%)				
Yes	14 (66.7)	7 (33.3)	13 (61.9)	9 (42.8)
No	7 (33.3)	14 (66.7)	8 (38.1)	12 (57.2)
Diagnosis (%)				
Low back strain/sprain	9 (42.9)	13 (61.9)	10 (47.6)	12 (57.1)
Mechanical problems (fusion)	2 (9.5)	1 (4.8)	3 (14.3)	1 (4.8)
Disc/nerve root	3 (23.8)	3 (14.3)	2 (9.5)	3 (14.3)
Laminectomy	0 -	0 -	1 (4.8)	2 (9.5)
Discectomy	3 (14.3)	4 (19.0)	5 (23.8)	1 (4.8)
Spondy's	2 (9.5)	0 -	0 -	2 (9.5)
Back Operations (%)				
None	15 (71.4)	17 (81.0)	13 (61.9)	14 (66.7)
One	4 (19.0)	4 (19.0)	4 (19.0)	3 (14.3)
Two	2 (9.5)	0 -	4 (19.0)	1 (4.8)
Three	0 -	0 -	0 -	3 (14.3)
Outcome expectancy (mean %)	31.9	41.9	44.29	40.48
S.D.	18.87	20.46	22.03	24.13
Beck Premeasure (%)				
Normal	4 (19.0)	9 (42.9)	8 (9.5)	9 (42.9)
Mild	14 (66.7)	8 (38.1)	4 (19.0)	5 (23.8)
Mild-Moderate	2 (9.5)	3 (14.3)	4 (19.0)	3 (14.3)
Moderate-Severe	1 (4.8)	1 (4.8)	4 (19.0)	4 (19.0)
Severe	0 -	0 -	1 (4.8)	0 -

1. Relaxation Group
2. Imagery Group
3. Relaxation and Imagery Group
4. Psychoeducational Group

Table 2

Means, Standard Deviations, and Statistical Analysis for Relaxation Training (R), Imagery Training (I), Mixed Relaxation and Imagery, and Psychoeducational Training (P) on Alternate Simultaneous Treatment.

Treatment (hours)	R	I	M	P	Posttreatment/ Newman-Keuls
Physical Therapy					
M	6.63	11.26	6.98	8.95	I>RM*
SD	4.33	5.04	4.37	3.72	
Occupational Therapy					
M	10.31	9.93	10.09	14.43	ns
SD	5.24	6.14	6.34	8.85	
Exercise Therapy					
M	9.96	10.02	7.40	8.57	ns
SD	7.47	8.52	5.89	7.65	
Recreation Therapy					
M	1.46	1.17	1.45	.85	ns
SD	2.85	2.75	3.06	2.43	
Free Time					
M	5.87	6.27	2.58	2.74	ns
SD	6.52	8.19	4.79	4.47	

* Significance determined at $p < 0.05$ level
ns = not significant

Table 3

Means, Standard Deviations, and Statistical Analysis for Relaxation Training (R), Imagery Training (I), Mixed Relaxation and Imagery (M), and Psychoeducational Training (P) on Manipulation Perception. Posttreatment

Measure	R	I	M	P	Posttreatment/ Newman-Keuls
Taught Relaxation Skills					
M	2.71	.81	2.52	.47	RM>P: RM>I*
SD	.46	.715	.60	.68	
Taught Imagery Skills					
M	.62	2.62	2.48	.09	IM>R: RIM>P*
SD	.49	.67	.60	.44	
Taught Assertiveness Skills					
M	.86	.43	.62	.14	RM>P: R=I=M
SD	.65	.68	.74	.48	
Taught Lifting Skills					
M	.19	.28	.19	.00	ns
SD	.40	.56	.51	.00	

* Significance determined at $p<0.05$ level
ns = not significant

= .46) and relaxation + imagery (X = 2.52, SD = .60) groups highly endorsing this intervention as opposed to the imagery (X = .81, SD = .75) or psychoeducational (X = .47, SD = .68) group. On the imagery skills check a significant difference was found $F(3,80) = 110.99$, $p < .000$, with the imagery (X = 2.62, SD = .67) and relaxation + imagery (X = 2.48, SD = .60) groups highly endorsing the intervention as opposed to the relaxation (X = .62, SD = .49) and psychoeducational (X = .09, SD = .44) groups. On the assertiveness skills check a significant difference was found $F(3,80) = 4.61$, $p = .005$, with the relaxation (X = .86, SD = .65) and relaxation + imagery (X = .62, SD = .74) endorsing this skill as being taught as opposed to the imagery (X = .43, SD = .68) and psychoeducational (X = .14, SD = .48) groups. Given the means were so low on this Likert-type (0-3) scale it is possible that assertiveness was either endorsed by response error or as a by-product of interventions which had relaxation as a component. No significant differences were found on the lifting skills check. Overall the manipulation check supports that the treatment interventions endorsed by the subjects were consistent with what the therapist purported to be teaching as an experimental manipulation in each of the treatment conditions. Given this finding with the review of interventions by video-tape, as analyzed by three senior psychologists prior to the research, the conclusion that the interventions are unique is strongly supported.

C. Contrast Analysis

One-way ANOVAs performed on all dependent measures at pretreatment revealed no significant differences (tested at the $p < .05$ hypothesis-wise level) between the groups on: AMpain, PMpain EVpain, BDI and STAI-state scale. Difference scores were used to minimize the effects of individual differences in the various dependent variables across individuals. Contrasts performed on each dependent measure are reported in terms of difference scores (*D*) on group means: depression (BECKD), state-anxiety (STATED), AMpain (AMD), PMpain (PMD), and Evening pain (EVD).

Depression. Using the specified contrasts as respective comparison hypotheses, no significant results were found on the BECKD scores following treatment (see Table 4). Only the BECKD score for the treatment groups $t(80) = 1.39$, $p = .167$, that is, relaxation ($X = -2.89$, $SD = 4.5$), imagery ($X = -2.47$, $SD = 3.67$) and relaxation + imagery ($X = -2.47$, $SD = 4.21$), as opposed to the psychoeducational group ($X = -.95$, $SD = 4.19$) approached significance.

Anxiety. Using contrast 1 as the hypothesis comparison, which suggests that the treatment groups would perform better than the psychoeducational group on state anxiety reduction, results were obtained (see Table 5) to support this contention as the STATED scores $t(80) = 2.35$, $p = .022$ for the relaxation ($X = -6.19$, $SD = 8.16$), imagery ($X = -3.95$, $SD = 10.02$) and relaxation + imagery ($X = -7.10$, $SD = 11.66$) group significantly differed from the

Table 4

Means, Standard Deviations, and Statistical Analysis for Relaxation Training (R), Imagery Training (I), Mixed Relaxation and Imagery (M), Psychoeducational Training (P), Conditions Pretreatment, Posttreatment, and Difference Scores for Self-Report of Depression.

Measure		R	I	M	P	Pretreatment/ Newman-Keuls	Contrasts (1)	(2)	(3)
				Depression					
Beck Depression									
Pre									
	M	12.48	11.24	13.81	12.29	ns			
	SD	5.88	5.87	7.70	7.85				
Post									
	M	10.19	8.76	11.33	11.33				
	SD	6.13	5.07	8.22	6.26				
Difference									
	M	-2.29	-2.47	-2.47	-.95		ns	ns	ns
	SD	4.52	3.67	4.21	4.19				

Table 5

Means, Standard Deviations, and Statistical Analysis for Relaxation Training (R), Imagery Training (I), Mixed Relaxation and Imagery (M), Psychoeducational Training (P), Conditions Pretreatment, Posttreatment, and Difference Scores for Self Report of State Anxiety.

Measure	R	I	M	P	Pretreatment/ Newman-Keuls	Contrasts (1)	(2)	(3)
			State Anxiety					
State-Trait Anxiety Inventory								
Pre								
M	45.14	46.67	48.81	45.67	ns			
SD	11.62	11.19	13.41	11.50				
Post								
M	38.95	42.71	41.71	45.52				
SD	11.46	8.91	10.49	11.44				
Difference								
M	-6.19	-3.95	-7.10	-.14	RIM>P**	ns	ns	
SD	8.16	10.02	11.66	7.54				

psychoeducational group (X = -.14, SD = 7.54). No evidence was found to support the other two hypotheses, dictated by the proposed contrasts, that suggested differences between the active treatments.

Subjective Pain (a.m.). Using contrast 1 as the hypothesis it was found that there was a significant difference on AMD scores $t(80) = 2.99$, $p = .004$ with the active treatments shown to be effective, that is, relaxation (X = -.51, SD = 1.43), imagery (X = -.30, SD = 1.55) and relaxation + imagery (X = -.37, SD = 1.23), as opposed to the psychoeducational group (X = -.62, SD = 1.11) whose score increased (see Table 6).

Subjective Pain (p.m.). Using contrast 1 as the hypothesis it was found that there was a significant difference on the PMD scores $t(80) = 2.41$, $p = .018$ with the active treatments shown to be more effective, that is relaxation (X = -.56, SD = 1.33), imagery (X = -.30, SD = 1.41), and relaxation + imagery (X = -.34, SD = 1.16), than the psychoeducational group (X = .37, SD = 1.14) whose scores increased (see Table 6).

Subjective Pain (evening). Using contrast 1 as the hypothesis it was found that there was a significant difference on the EVD scores $t(80) = 3.51$, $p = .001$, with the treatments exerting an overall effect, that is relaxation (X = -.57, SD = 1.75), imagery (X = -.43, SD = 1.40) and relaxation + imagery (X = -.73, SD = 1.10), as opposed to the psychoeducational group (X = .65, SD = 1.20)

Table 6

Means, Standard Deviations, and Statistical Analysis for Relaxation Training (R), Imagery Training (I), Mixed Relaxation and Imagery (M), Psychoeducational Training (P), Conditions Pretreatment, Posttreatment, and Difference Scores for Self-Report of Subjective Pain.

Measure	R	I	M	P	Pretreatment/ Anova	Contrasts (1)	(2)	(3)
Subjective Pain								
Visual-analogue-scale daily average 3 day pain								
AM pain								
Pre								
M	**5.08**	**6.11**	**6.19**	**5.14**	**ns**			
SD	**1.86**	**1.81**	**1.78**	**1.68**				
Post								
M	**4.57**	**5.81**	**5.83**	**5.76**				
SD	**1.86**	**1.99**	**2.04**	**1.52**				
Difference (D)								
M	-.51	-.30	-.37	.62		RIM>P*	ns	ns
SD	1.43	1.55	1.23	1.11				
PM pain								
Pre								
M	5.94	6.11	6.78	5.95	ns			
SD	1.32	1.37	1.45	1.39				
Post								
M	5.38	5.81	6.50	6.32				
SD	1.78	1.89	1.53	1.38				
Difference (D)								
M	**-.56**	**-.30**	**-.34**	**.37**		**RIM>P***	**ns**	**ns**
SD	**1.33**	**1.41**	**1.16**	**1.14**				
EV pain								
Pre								
M	**5.94**	**6.35**	**7.03**	**6.17**	**ns**			
SD	**1.57**	**2.19**	**1.42**	**1.67**				
Post								
M	**5.37**	**5.92**	**6.30**	**6.82**				
SD	**1.95**	**2.28**	**1.51**	**1.35**				
Difference (D)								
M	**-.57**	**-.43**	**-.73**	**.65**		**RIM>P****	**ns**	**ns**
SD	**1.75**	**1.40**	**1.10**	**1.20**				

ns not significant
* significance determined at p<0.05 level
** significance determined at p<0.005 level

whose scores increased (see Table 6).

A summary of the above findings on the *D* scores on all dependent measures indicate that, with the exception of the BECKD analysis, the active treatment groups were superior to the psychoeducational group in therapeutic effectiveness. The BECKD in the active treatment groups also approached significance at the $p < .10$ level. Alternate hypotheses that differences would be found in comparisons of active treatments (relaxation + imagery versus imagery; imagery versus without imagery) were not supported by this statistical analysis.

As an alternate method to the five univariate analyses of the dependent measures, a MANOVA with the same contrasts was conducted. Using Wilk's lambda criterion throughout found the only contrast to be significant was contrast 1, $F(5) = 4.375$, $p = .001$, which purports the active treatments to be significantly different than the psychoeducational treatment group (see Table 7).

D. Subjective Course Effectiveness Evaluation

A multiple analysis of variance (fixed effects, equal N's) was conducted to examine perceived treatment effectiveness differences between the 3 active intervention groups on a 8 question, 0-3 Likert-type course effectiveness evaluation questionnaire. A multivariate test for homogeneity of dispersion matrices was conducted with supporting evidence to suggest that the response range of

Table 7

Multiple Analysis of Variance on Treatment (contrast) Effects

Source	Wilk's	dF	Exact F	P
Contrast 1 (RIM to P)	.7765	5	4.375	.001**
Contrast 2 (I to M)	.9729	5	.4219	.832
Contrast 3 (R to IM)	.9866	5	.2061	.959

* $p < .005$

0-3 on the scale did not violate assumptions of variance and covariance, $F(108, 14217)$, df = .96, p = .583. Hence perceived effectiveness was analyzed in terms of the independent effects due to: relaxation (R), imagery (I), and relaxation x imagery (RxI). A MANOVA using Wilk's lambda criterion throughout found significant effects for relaxation $F(8) = 2.37$, p = .025 and imagery, $F(8) = 3.457$, p = .002, but not relaxation by imagery (see Table 8). Univariate tests for significance were set at $p < .01$ for each univariate (8 dependent variable course evaluation questions), therefore the overall alpha level given that they are independent of one another is kept to .077. On a question concerning a better understanding of the nature of pain, significance was determined for imagery, $F(1,80) = 7.49$, p = .008, but not relaxation (see Table 9). On the item related to a positive change in the perception of the presenting back problem none of the conditions proved significant. With respect to being better able to control worried thoughts, significance was found for imagery, $F(1,80) = 12.31$, p = .001, but not relaxation. In an outcome expectancy measure of using the taught intervention skills to control anticipated pain, significant results favoured imagery, $F(1,80) = 7.75$, p = .007, but not relaxation. On an item related to perceived present ability to control back pain, significance was found in relaxation, $F(1,80) = 8.22$, p = .005, and imagery, $F(1,80) = 12.05$, p = .001. Analyzing the perceived present ability to manage one's overall back

Table 8

Multiple Analysis of Variance on Course Effectiveness Evaluation

Source	Wilk's	dF	Exact F	P
Relaxation	.7983	8	2.370	.025*
Imagery	.7252	8	3.457	.002*
Relaxation and Imagery	.8386	8	1.755	.100

* $p < .05$

** $p < .005$

Table 9

Summary of Subjective Course Effectiveness Questionnaire, giving means, standard deviations, and overall F significance differences for each treatment group.

No.	Question Item	Treatment Groups: Relax (N=21) X	SD	Image (N=21) X	SD	R + I (M) (N=21) X	SD	Psych Ed. (N=21) X	SD	F Significance (R, I, RxI)
1.	Increased pain knowledge	2.14	.79	2.29	.72	2.24	.70	1.48	.81	I>RM*
2.	Changed back problem perception	1.81	.87	1.81	.87	1.86	.96	1.14	.91	ns
3.	Control worry	1.71	.64	2.05	.86	1.81	.87	1.62	.90	I>RM**
4.	Skills will help	1.473	.75	1.81	.61	1.62	.80	1.05	.80	I>RM*
5.	Control back pain	1.05	.67	1.14	.66	1.43	.93	.429	.598	IR>M**
6.	Manage back better	1.19	.60	1.33	.80	1.524	.87	.67	.73	I<RM**
7.	Expect benefits if practice	1.86	.655	2.05	.669	2.29	.78	1.00	1.0	RI>M**
8.	Feel more positive	1.81	.93	1.95	.81	2.19	.75	1.33	.79	I>RM*

Note Scale Range: 0 - Not at all: 1 - To a slight degree: 2 - To a moderate degree: 4 - To a great degree.

ns: nonsignificance

* $p < .01$

** $p < .005$

problem, significance was found for imagery, $F(1,80) = 9.17$, $p = .003$, but not relaxation. In a question relating to perceived general benefits of skills learned if practised, significant results were obtained for relaxation, $F(1,80) = 10.11$, $p = .002$, and imagery, $F(1,80) = 18.37$, $p < .000$. Lastly, the imagery group perceived themselves to be more positive as a result of their respective intervention, $F(1,80) = 7.76$, $p = .007$, than the relaxation group.

In brief summary of the above results, the independent effects of imagery were significant in all assessed items of perceived improvement, with the exception of improvement in back problem perception. Relaxation proved significant on two items only: controlling back pain and perceived general benefits if practiced. In couching these perceived course effectiveness evaluations within the entire research context, an orthogonal analysis revealed that all active treatments differed significantly on all items from the psychoeducational group.

E. Follow-up Questionnaire

A multiple analysis of variance with a contrast design (fixed effects, equal N's) was conducted on a 2 month follow-up questionnaire to examine continued treatment influences on a variety of items pertaining to general well-being. The independent comparisons designed were: relaxation to imagery (R to I); and relaxation and imagery to relaxation + imagery (R, I to M). A multivariate test for

the dispersion of matrices was not significant, $F(182, 8611)$, df = 1.146, p = .088. The MANOVA using Wilk's lambda criterion found no significant effects comparing relaxation to imagery, $F(13) = 1.183$, p = .319, but significance was found in comparing combined (or mixed) relaxation + imagery treatment to relaxation and imagery alone, $F(13) = 2.138$, p = .038 (see Table 10). The only subsequent univariate test of significance was found on item 68, "better understanding of pain", $F(1,57) = 7.62$, p = .008. All treatment groups indicated a minimum of improvement, 'To a slight degree', on all of the follow-up questions, noting some perceived treatment influences. Means and standard deviations for each question are reported in Table 11. Questions more specifically related to the dependent measures of depression (items 3, 4, 5, 12 & 13), anxiety (items 1 & 2), and subjective pain experience (items 6, 7, 8 & 9) all showed improvement as noted by each of the research participants.

F. Ancilliary Analysis

Pearson correlations

Pre-post treatment variables. Given the results of an intercorrelation procedure (see Table 12) it appears that a strong relationship exists between state anxiety and depression in this chronic low back pain sample. In particular it is notable that as symptoms of depression were indicated, symptoms of state anxiety were also more likely

Table 10

Multiple Analysis of Variance on Follow-up Questionnaire (contrasts).

Source (contrast)	Wilk's	dF	Exact F	P
R to I	.7444	13	1.188	.319
R, I to M(R+I)	.6181	13	2.138	.030*

* $p < .05$

Table 11

Summary of Subjective Two-month Follow-up Quetionnaire. giving means and standard deviations for active treatment groups.

		Treatment Groups							
No.	Question Item	Relax (N=20)		Imagery (N=20)		R + I (N=20)		Total Grps (N=60)	
		X	SD	X	SD	X	SD	X	SD
1.	More comfort/relaxed	1.55	.83	1.60	.75	1.85	.49	1.67	.71
2.	Control Worry	1.35	.67	1.65	.88	1.50	.61	1.50	.73
3.	Self-esteem	1.75	.72	1.90	.85	1.85	.59	1.83	.72
4.	Sleep better	1.90	.85	1.45	1.10	1.75	.85	1.70	.94
5.	Social relations better	1.80	.62	1.55	.89	1.80	.62	1.72	.72
6.	Pain knowledge	2.20	.62	2.35	.67	2.75	.79	2.20	.73
7.	Control pain better	1.50	.83	1.40	.82	1.70	.73	1.53	.79
8.	Decrease medications	1.30	1.08	1.95	1.05	2.00	.73	1.75	1.02
9.	Manage back problem	1.45	.83	1.80	.70	1.45	.51	1.57	.69
10.	Practiced skills learned	2.05	.83	1.95	.89	1.80	.89	1.93	.86
11.	Liked instructor	2.70	.47	2.50	.69	2.50	.69	2.56	.62
12.	Feel more positive	1.95	.76	2.05	.83	2.20	.62	2.07	.73
13.	Participation helped me return to work	1.55	.89	1.60	.94	1.75	.64	1.63	.82

Note Scale Ratings Range: 0 - Not at all; 1 - To a slight degree; 2 - To a moderate degree; and, 3 - To a great degree.

Table 12

Intercorrelations of variable pretreatment/posttreatment (total group). [Due to the number of correlations, stringent criteria of significance were set at $p < .005$].

	AGE	EXPECT	BECK 1	STATE 1	AM pre	PM pre	EV pre	BECK 2	STATE 2	AM post	PM post	EV post
AGE	-	-.26	-.11	-.08	.04	.14	.01	-.12	-.19	-.12	-.03	-.08
EXPECT		-	-.13	-.09	-.15	-.26	-.16	-.14	.04	-.05	-.01	-.02
BECK1			-	.67*	.17	.13	.21	.81*	.60*	.23	.17	.18
STATE1				-	.19	.08	.11	.62*	.63*	.20	.06	.06
AMpre					-	.65*	.53*	.18	.01	.72*	.58*	.57*
PMpre						-	.74*	.11	.05	.56*	.67*	.59*
EVpre							-	.20	.16	.49*	.56*	.67*
BECK2								-	.64*	.26	.18	.18
STATE2									-	.23	.16	.17
AMpost										-	.84*	.77*
PMpost											-	.86*
EVpost												-

* $p < .005$

to be endorsed, both at pretreatment ($r = .67$, $p < .000$) and posttreatment ($r = .64$, $p \leq .000$). As well there was a significant relationship between the pretreatment score of the Beck (Beck1) and the posttreatment measure of state anxiety (State2) ($r = .60$, $p < .000$) and the pretreatment score of state anxiety (State1) and the post Beck (Beck2) score ($r = .62$, $p < .000$). These results continue to support the view that depression and anxiety play an intricately related role in the chronic low back pain syndrome. With respect to pre and post pain measures, it is self-evident by reviewing Table 12 that a close and consistent relationship exists between all measures of pain. Interestingly, no significant relationship was detected on any pretreatment or posttreatment measures of depression and state anxiety with those concomitant measures of subjective pain. This suggests the emotional state of the sample did not significantly alter their level of reported subjective pain either prior to or post treatment.

Pretreatment-difference score variables.

Intercorrelations for pretreatment-difference score dependent measures (see Table 13) indicates a significant relationship on all pretreatment scores, and the respective difference score measures. In particular, those who scored high on the Beck pretreatment had smaller difference scores posttreatment ($r = -.38$, $p < .000$) indicating that those more depressed were less likely to show improvement. High pretreatment scores on state-anxiety similarily followed the

Table 13

Intercorrelations of variables pretreatment/difference scores (total group). [Due to the number of correlations, stringent criteria of significance were set at p < .005].

	BECKD	STATED	AMD	PMD	EVD
AGE	-.01	-.12	-.21	-.19	-.11
EXPECT	-.01	.16	.13	.27	.17
BECK1	-.38*	-.15	.09	.07	-.02
STATE1	-.12	-.52*	.03	-.01	-.06
AMpre	-.01	-.23	-.32*	.04	.08
PMpre	-.06	-.04	-.09	-.21	-.15
EVpre	-.03	.04	-.02	-.07	-.35*
BECKD	-	.16	.04	.07	.01
STATED		-	.29*	.17	.09
AMD			-	.61*	.43*
PMD				-	.71*
EVD					-

* P < .005

Note correlations deleted can be found in Table 12.

same pattern as depression, indicating the more anxious an individual, the less likely there is the possibility of improvement ($r = -.52$, $p < .000$). Two of the pain measures followed in the same fashion as higher pretreatment scores (AMpre & EVpre) realized lower improvement at the end of the treatment (Pain *D* scores) for AMpain ($r = -.32$, $p = .001$) and EVpain ($r = -.35$, $p = .001$). The state anxiety difference score was also positively related to the AM difference score ($p = .29$, $p = .003$), indicating the less state anxiety experienced early morning, the less reported subjective pain. Finally, all of the difference scores on pain were significantly rated ($p < .005$) indicating general pain management or reduction in one part of the day is likely to lead to reduction at other times of the day. Interestingly, no significant relationship was found for expectation levels in any of the pre, post or difference score measures.

Difference score issues

The author is aware that it has been reported in the literature (e.g., Keppel, 1973; Linn & Slinde, 1977) that the use of difference scores is a cause for concern due to: the unreliability (or low reliability) inherited by the difference score from the pre- and posttest measures reducing the precision (and power); and the correlation between the determined change (difference score) and the initial states (prescore) which is considered to give a clear advantage to persons with certain values on the

prescores. Rogosa, Brandt and Zimowski (1982) challenged the 'illusory' deficiencies attributed to difference scores in the literature (such as the aforementioned concerns) suggesting that the numerous statements suggesting that the difference score is unfair appears extraordinary given that for each individual, the difference score is an unbiased estimate of true change (e.g., postscore minus prescore). With respect to the correlation issue, they argue how it is that an unbiased estimate can be perceived as inequitable. They also argue and demonstrate that difference scores can be accurate and useful as measures of individual change even in situations where reliability is low. They further note that low reliability does not necessarily imply a lack of

treatment versus psychoeducational treatment) on all measures, except BECKD. No evidence was found to support proposed active treatment group differences. A reanalysis of difference score measures was conducted using a two-way ANOVA. It was the author's intention to address the gist of the original hypothesis concerning potential differences between active treatment formats on a male chronic low back pain compensation sample. Since this is a reanalysis of the original data, caution must be exercised in the interpretation of the data a second time as alpha levels can accumulate to unreasonable levels. Nevertheless, given this caution, an exploratory reanalysis may shed some additional insight on the outcome measures. All dependent measures were analyzed in terms of the independent effects due to:

Table 14

Summary of Two-Way Analysis of Variance of BECKD Measure

Source	MS	dF	Exact F	P
Relaxation	9.333	1	.540	.465
Imagery	15.429	1	.892	.348
Relaxation and Imagery	9.333	1	.540	.465

Table 16

Summary of Two-Way Analysis of Variance of AMpain Difference Score Measures (AMD)

Source	MS	dF	Exact F	P
Relaxation	7.440	1	4.148	.045*
Imagery	3.176	1	1.771	.187
[illegible]ery	5.938	1	3.310	.073

[illegible]alysis of Variance of PMpain Difference Score

MS	dF	Exact F	P
4.762	1	3.0228	.086
1.037	1	.659	.419
4.148	1	2.638	.108

Table 18

Summary of Two-Way Analysis of Variance of EVpain Difference Score Measures (EVD)

Source	MS	dF	Exact F	P
Relaxation	12.190	1	6.338	.014*
Imagery	8.048	1	4.184	.044*
Relaxation and Imagery	4.450	1	2.314	.132

* $p < .05$

significant effect in terms of the dependent outcome measures. Imagery alone was significant only once and a relaxation x imagery interaction proved not to be significant on all of the dependent measures.

Physical therapy as a covariate

As a previous analysis revealed significant differences in the amount of physical therapy each group received, with the imagery group receiving more than the relaxation and relaxation + imagery groups, a two-way ANCOVA was performed to control for known variability due to group differences in physical therapy time. In no one case did the variability associated with physical therapy effect the outcome measures of treatment significance as found in the above discussed exploratory two-way ANOVA. Thus, the amount of physical therapy any one group simultaneously received had a minimal and nonsignificant effect on the dependent outcome measures of the study.

VI. Discussion

The results of the study are open to somewhat different interpretations dependent upon how the data is analyzed. In order to maintain a sense of scientific credibility, the results based upon the primary orthogonal contrast design will be discussed first, followed by comments that pertain to the secondary exploratory reanalysis of the data.

Based upon the contrast design, the results of the current study suggest that the active interventions, which incorporated relaxation, imagery or both, showed significant improvement on subjective pain and state-anxiety in comparison to the passive psychoeducational comparison group. Although reductions of depression were not significant, they did approach significance for the active intervention treatment groups. No evidence was found to support the hypothesis that the active interventions would differ between one another on the dependent measures. Specifically, no differences were found comparing imagery interventions to relaxation with imagery or in comparing treatments without imagery to those with imagery as a component.

The evidence comprised in this study suggests that all three active treatment groups led to a minimum level of improvement in comparison to the psychoeducational group. The findings of this study are consistent with the documented research supporting the efficacy of relaxation (e.g., Turner, 1982), imagery (Rybstein-Blinchuk, 1979) or

both (e.g., Turk, Meichenbaum & Genest, 1982) as interventions for chronic pain. No differences were found on the outcome measures as a result of different treatment interventions, that is, the manipulated technique variables (relaxation or imagery). These findings are commensurate with numerous psychological treatment outcome research articles that purport failure in identifying one superior therapeutic approach (e.g., Frank, 1979; Smith, Glass & Miller, 1980). Some researchers estimate that less than 10% of outcome variance is generally accounted for by technique variables alone (Smith, Glass & Miller, 1980). Perhaps this same phenomenon holds true as a possible explanation for the claimed effectiveness of various psychological interventions for the treatment of clinical pain. Melzack and Wall (1982) however attribute the claimed effectiveness of various forms of psychological intervention to attenuate pain, irrespective of actual technique (e.g., EMG or hypnosis), a by-product of research that is difficult to assess scientifically because of problematic research design (e.g., lack of control). Similar criticisms have been aforementioned in this document, and as a consequence the design of this study is in response to this problem identified in previous research. The findings within the contrast design analyses suggest that no significant active treatment differences were observed.

The overall reduction in the subjective pain-intensity rating of the active treatment groups in comparison to the

passive psychoeducational group presents as evidence contrary to the notion of compensation neurosis which implies that a pain complaint is maintained in cases where financial compensation is pending, even if therapeutic intervention is applied (Block, Kremer & Gaylor, 1980b). Evidence from the current study suggests that with this chronic pain compensation population, pain reduction is possible therefore minimizes the possible detrimental effect compensation has on treatment outcome, a finding consistent with other studies (e.g., Chapman, Brena & Bradford, 1981; Mendelson, 1984). Further to the possible confounding effects of compensation in the current study, as a variable, compensation has been found to have little explanatory value in identifying those who were dissatisfied with their inpatient pain treatment (Swanson, Swenson, Maruta & Floreen, 1978) or failed to predict those who demonstrated continued improvement after pain treatment with patients who failed to maintain gains experienced while hospitalized (Painter, Seres & Newman, 1980). Both of the above authors concluded that personality variables were more likely to account for treatment outcome. It is the author's opinion that along with potential personality variables that may factor into pain intensity, reduction or treatment response, the unique nature of the compensation system which is adversarial may interact with pre-disposed personality types or coping styles rather than monetary gains per se being perceived as reinforcement for continued pain. Perhaps the

adversarial compensation system provokes a psychological reactance (Brehm & Brehm, 1981) in patients which causes noncompliance to treatment regimens, psychological and physical, and consequently reduces optimal treatment effectiveness.

Another possible factor that may interact with the treatment of the chronic pain compensation patient is unrealistic optimism that exists prior to injury and the mind set of "magic bullet" medical consumerism. It is well documented in research that most people are unrealistically optimistic about their health and when illness or injury occurs it is anticipated that it can be quickly offset by personal effort (Weinstein, 1982, 1983). As a result of unrealistic optimism, which undermines legitimate health concerns, people are less likely to engage in preventative health behaviour or be accepting of a health oriented intervention when needed. If people are then convinced about the need for health intervention, expectations for subsequent repair or healing by intervening medical technology is in turn very high. The success of medical intervention often meets these expectations. The 'quick fix' mind set is a fairly common phenomenon. With the compensation chronic pain patient, there are a few digressions to the above described sequence of events. Prior to injury there is no evidence to the author's knowledge that suggests that eventual compensation chronic pain patients differ from others in an unrealistic optimism for

health. However because of an industrial accident which typically marks the onset for medical intervention, compensation clients are not likely to resist intervention partially because injury and subsequent rehabilitation justify eligibility for compensation benefits. Further, it is equally plausible that industrial accident patients expect a quick and successful recovery, primarily due to perceived technological advances in medicine to "fix things physical." When formal medical attempts do not ameliorate physical problems, coupled with continued pain and disability, proposed psychological interventions (to "fix things physical by things mental") typically lead to varied levels of resistance. Within the compensation system, benefits to compensation claimants are justified by concrete causes (industrial accident) and concrete effects (physical disability). By definition alone, a compensation patient should be resistant to interventions other than those that formally intervene at a physical (concrete) level. In this study, despite possible impediments to treatment success within the compensation system (e.g., magic bullet mind set; resistance; etc.), positive results were found by means of psychological intervention within a short time frame suggesting the effects, although minimal, are yet very powerful. The fact that within a two week period of time a reduction in pain intensity was observed suggests that the chronic low back pain compensation population is a suitable one for psychological intervention and more importantly

future research.

Based upon the active psychological interventions, significant reduction was demonstrated in state-anxiety. Research suggests that chronic pain often involves anxiety as an experience that is not only unpleasant but is accompanied by concomitant muscle tension and physiological consequences of autonomic arousal that exacerbate the pain experience (Alcock, 1986; Taylor, 1986). Often the failure of medical treatment to alleviate the experience of pain and consequential disability can be anxiogenic in itself (Trief, Elliot, Stein & Frederickson, 1987). The fear of future pain and medical procedures coupled with a tenuous physical, occupational, social and financial life adds to an accumulating anxiety effect. Therefore anxiety reduction may be the key to successful psychological intervention and rehabilitation. Directly or indirectly, all three active treatment groups may have attained anxiety reduction by means of inattention, internal diversion or transformation of pain as a result of the skills taught. Following completion of the course all three active treatment groups also indicated feeling more positive in general than before the program, an indicator for anxiety reduction.

Depression, as indicated in this document, is a variable that is controversially linked to chronic pain. Some authors have argued that depression is a concomitant response to chronic pain (e.g., Fordyce, 1976; Sternbach, 1974), while other viewpoints assert that chronic pain that

is obscure in origin is a variant of depressive disease (e.g., Blumer & Heilbronn, 1982). Based upon the research participants' responses to the Beck Depression Inventory, using a conservative cut-off score of 16 (mild-moderate depression), it was found that 27% of the CLBP patients in this study have concurrent indicators of depression. This rate is consistent with other known studies of chronic pain (e.g., Turner & Romano, 1984) and specifically chronic low back pain (e.g., Love, 1987). Participants of this study were individuals who were forced to withdraw from their employment due to injury, and remain off work because of injury and debilitating persistent pain. Turk & Salovey (1984) assert that those who suffer loss as a result of an industrial accident suffer reactional depression. There appears no offsetting evidence to suggest that the group of CLBP participants of this study are different from any other CLBP group studied previously.

The suggested relationship between chronic pain and depression can be readily understood within the reformulated learned helplessness model (Abramson, Garber & Seligman, 1980). Unremitting pain that persists in spite of individual and medical efforts to reduce hurt may result in the patient perceiving themselves in a helpless state. It is argued by the above cited authors that helplessness leads to depression as consequence of attributional dimensions overwhelming the individual's cognitive coping mechanism. Hence the external attribution for chronic pain translates

into, 'No medical intervention can rid me of my pain'. Internal attributions translate into, 'I can't do anything about my pain'. The stability dimension leads to an attribution that suggests, 'I will be plagued by a chronic back problem forever'. Often unguided individual coping efforts have no effect on managing chronic pain (Rosenstiel & Keefe, 1983). This seemingly personal incompetence spreads to the formulation of a global attribution, 'I'm just an incompetent person'. Implications of the above attributions lead to pervasive decrements in motivation, cognition and behaviour.

Because the active interventions failed to significantly reduce the measured levels of depression, explanations are warranted. One plausible factor that may have contributed to the depression score results is that the treatment time was not long enough for the intervention to exert the necessary magnitude of effect for statistical significance. Given that the mean duration of back problems was approximately 5 years it may be unlikely that levels of depression are to change, especially if attributions such as those mentioned above (along with subsequent motivational and behavioural decrements) are well-entrenched. An alternate explanation for no change in the measured depression score could also be that those questions on the BDI that contribute to the overall level of depression are primarily somatic complaints that are also indicative of a chronic pain state. If those somatic concerns remain the

same, concurrent indicators of depression will also remain at the same level. The confounding effects of using the BDI will be discussed in the "inherent limitations" section.

Other findings of the study are worthy of mention. The observation that as the pretreatment scores on the dependent measures increased, the less likely there would be a subsequent improvement, follows a common understanding that in interventions that require a minimum level of effort and concentration, interfering factors (e.g., extreme pain or high anxiety) may reduce the person's ability to put good effort into skill acquisition (e.g., imagery) thereby reducing its optimal effectiveness or prevent skill acquisition all together. Of further interest is the finding that the severity of perceived pain was independent or more appropriately uncorrelated to the level of depression or state-anxiety the patient was experiencing. It is commonly accepted that the more depressed or anxious the individual, the more pain experienced. In this male CLBP population, no inference with respect to the above statement can be made. Currently, it is not clear whether or not anxiety and/or depression are the cause or the result of chronic pain (e.g., Fishbain, Goldberg, Meagher, Steele & Rosomoff, 1986). The present study did not address this issue. However they do appear as concurrent factors that may maintain a chronic pain syndrome. In this study the scores of depression and state-anxiety were found to be highly correlated. It has been noted elsewhere that both of these

psychological states, as measured by self-report and diagnostic interview, are prevalent in the chronic pain compensation population (Fishbain, Goldberg, Labbe, Steele & Rosomoff, 1988).

Differences between active versus passive treatment interventions also require consideration. It is possible that as a result of the contrast design no differences in effectiveness were found in the three active treatments because they share a common underlying mechanism that operates to help the CLBP patient. Possibly, the differences in the interventions are only semantic. Based upon the utilized scripts or protocols, and what the patients actively practised (i.e., relaxation and/or imagery), those differences may be perceived in a critical analysis as surface structure differences. It is plausible that those technical interventions elicit a common deep structure response that yields an equal effect across variations in psychological technique. Based upon the contrast design, inferences about what that deep structure response is cannot be made. Perhaps though, the efficacy of the active interventions is not a deeply rooted direct psychophysiological response, but rather a cognitive response (direct or indirect) that offers control to an individual suffering from CLBP.

Lang's (1979, cited in Feuerstein, Labbe & Kuczmierczyk, 1986) bio-informational theory of emotional imagery, which integrates cognitive psychology and

psychophysiology, may be a useful heuristic tool for understanding the deep structure response which acts to influence the psychological correlates of CLBP. According to Lang an image in the brain represents a propositional network that regulates specific somatovisceral patterns (autonomic and skeletal muscles) consequently effecting overt behaviour. Lang argues that the propositional structure is the basis for the emotional content and structure. Further, feedback from the somatovisceral and verbal reports output to brain processes responsible for the initial propositional network influencing the emotional experience and associated behaviour. Hence, influencing this network by changes in verbal report, efferent fibre responses (e.g., progressive muscle relaxation) or image content (e.g., guided imagery) may serve to modify the experience of CLBP.

Because CLBP patients are unemployed and suffer from a chronically disabling condition, there is strong evidence to suggest that they are experiencing stress (Fleming, Baum, Reddy & Gatchel, 1984). Stress, using Lazarus and Folkman's (1984) criteria, may be defined within the CLBP population as the process of appraising CLBP and its associated events (e.g., myelogram or unemployment) as harmful and threatening, assessing the potential responses available and responding, that is increased pain, anxiety, or depression, etc. Uncontrollability and unpredictability are readily experienced by CLBP sufferers (perhaps moreso for

compensation claimants) and stress research has consistently identified these two factors as contributing to experienced stress (see Taylor, 1986). Role confusion and/or ambiguity further cause stress and as a result the patient may succumb to a sick-role state. Stress is reduced however if individuals are given a response that enables them to control or believe they control a stressful circumstance (e.g., Glass & Singer, 1972; Thompson, 1981). This can explain or be useful for understanding the beneficial effects of control-enhancing psychological strategies. It has been postulated that self-control is essential for self-concept and self-esteem (vulnerable psychological entities for CLBP patients) and further constitutes a fundamental psychological need (deCharms, 1968; White, 1959). Hence encouraging the reinstatement of self-control by providing an individual with a task or skill directed toward that end (directly or indirectly) may help in reducing the amount of stress experienced. If CLBP patients are provided with a skill that may give them control or make them believe they have control, they then may be able to predict, modify or terminate an aversive event (e.g., chronic pain). As a result cognitive (causal attributions), emotional, motivational and behavioural deficits may be reversed. With a rehabilitation setting, a shift in control from the medical establishment to the patient taking the form of self-responsibility is often desired, but the ritual working of health care rarely allows this to be

accomplished.

Essentially, the active interventions may have operated to augment self-efficacy (Bandura, 1977) by helping the CLBP patient not to feel at the mercy of a myriad of external forces beyond one's own control. Taylor, Lichtman and Wood (1984) found that control is generally adaptive, resulting in better adjustment to chronic illness in comparison to those who do not perceive control. Further, aversive events can be lessened by providing an individual with some concrete action to instill feelings of control (Thompson, 1981).

It is posited by the author that the active treatments proved more effective (e.g., pain reduction) than the passive psychoeducational group because the active groups were provided with a concrete coping skill, of a direct nature, that increased in each CLBP patient a sense of personal mastery. Gal and Lazarus (1975) pointed out that direct action is more effective than the absence of direct action when faced with stress as it instills a sense of mastery, control, diverts attention and discharges energy. Introducing a coping skill (relaxation or imagery) enables the patient to gain ownership of his pain experience and potentially its psychological correlates. The result may be an increased self-responsibility for the quality of life.

Clearly information (psychoeducational group) is not enough and possibly alone may be more detrimental as this intervention led to a slight increase in the subjective

measure of pain. Perhaps discussing pain and its psychological correlates served to have the CLBP patients become more sensitive to their pain as the information led them to focus on their pain, hence resulted in increased subjective reports of pain. Further, a consequence of the active treatment format included a dimension of cognitive focus, specifically during the relaxation and/or imagery exercise. In the psychoeducational group, because there was no coping exercise and therefore no specific cognitive focus it is possible that cognitive distortions are more likely to infiltrate, leading to catastrophizing thoughts in the absence of competing relaxation and/or imagery focused exercise. Typically it has been found that information reduces anxiety because it assures a person that an event (pain) will not become intolerable (Thompson, 1981). Information makes an event more predictable. But chronic pain for CLBP patients is not a predictible event, and failed interventions in the past may taint the perception of psychological information as being nothing more than a pep-talk, especially if no coping intervention is given. For example, information strategies (e.g., media) used in an attempt to change risk behaviour (e.g., smoking) plays a role in attitude change and possibly enhances the motivation to change but rarely leads to change in actual behaviour (Taylor, 1986). The information sessions provided to the psychoeducational group may have had minor motivational or attitudinal effects, but the actual change in pain,

depression and state-anxiety were not as significant as the active forms of intervention.

Another noteworthy finding of this study was that in the subjective course effectiveness evaluation questionnaire, the imagery group reported overall better improvement than the relaxation group with the exception of a pain control question and a practice efficacy question on which the two treatment groups did not differ. Perhaps the imagery group endorsed more positive ratings with respect to the overall course effectiveness questionnaire because the imagery exercises were inherently more enjoyable and cognitive in orientation, hence more likely to influence self-evaluative decisions with respect to improvement due to one's own efforts. On a two month follow-up questionnaire none of the three active treatment groups differed, all indicating slight to moderate benefits in all the queried areas of interest. An interesting finding in the two month follow-up was that all three treatment groups continued to utilize the coping skill they had learned during the program, indicating that the research participants must have accrued some benefit from the exercises (relaxation or imagery) otherwise they would not be involved in maintaining health related behaviour. Maintaining health behaviours and treatment compliance are perceived as major obstacles to health-habit modification programs and interventions (Taylor, 1986). As none of the participants in the study had ever been involved in a psychological treatment program for

chronic pain, it is possible that this form of intervention is novel, refreshing (different than all the other treatments) and personal, hence is more likely to lead to the maintenance of a learned health behaviour. In a check to ascertain whether the therapists' relationship with each of the treatment groups, as evaluated by the research participants two months later, may have been perceived as different and possibly influencing the subjective evaluations, no treatment group differences were indicated.

In the exploratory reanalysis of the original data, cautioned interpretation is required. The original contrasts were determined by comparisons of interest which, if orthogonal, are limited based upon the number of groups. One key treatment comparison omitted that proved to be significant on most dependent measures was the relaxation treatment. Why would the main effect of relaxation be so predominant? One plausible explanation is that with the current study's male compensation population and its known demographic variables, the explained rationale of relaxation to break the muscle tension-spasm cycle, together with its very simple, intellectually untaxing procedures proved to be more scientifically credible than other treatment groups' perception of their imagery or imagery component exercises. (Rationale and procedures were made equivalent as possible with respect to complexity and legitimacy as an intervention for CLBP). This credibility may have translated into significant reductions on the respective dependent measures.

Differences between the efficacy of relaxation and imagery as therapeutic modalities in this study may also be understood within a skill acquisition framework that delineates the acquisition of procedural knowledge, a fundamental area of study in modern cognitive psychology. Procedural knowledge is knowing how to do something. In order for relaxation and imagery skills to be effective it requires skill learning which usually occurs in three stages: (1) a cognitive stage in which a description of the procedure is learned; (2) an associative stage in which a method for performing the skill is devised; and (3) an autonomous stage, in which the skill becomes more rapid and automatic (Anderson, 1980). It is proposed that the effects of relaxation were most significant because of the rapid acquisition of the skills, its simplicity, which allowed for quick skill acquisition through all 3 stages, hence resulted in more significant treatment results in the short time period. With respect to imagery skill acquisition, it is the author's opinion that the stage 2 level of skill acquisition is the stage that requires the most time and may not have been completed by the end of the treatment period. Therefore although the dependent measures showed no improvement, the course effectiveness evaluation was overall endorsed optimistically. Furthermore, because procedures can facilitate or interfere with one another, the lack of improvement in the mixed treatment group (M) may be due to time effects, or short-term interference which may later be

resolved with self-devising methods to meaningfully, symbolically, amalgamate the two treatment procedures.

The effects of relaxation on approaching significance with depression and its effectiveness with overall pain and anxiety reduction may also be understood within a psychobiological perspective. Thus another hypothesis for the efficacy of relaxation training relates to the effects of relaxation on brain catecholamines and to the action of biogenic amines on depression. Given that depression is associated with increased anxiety and adrenalcortical activity (Klerman, 1983), it may be that relaxation training directly or indirectly influences the production of endorphins. Reynolds and Coats (1986) suggested that relaxation training has a direct effect on brain catecholamines and the action of biogenic amines on depression. Because depression was not significantly reduced, decrements in the BDI score cannot be used to support this position, although the trend is in that direction. A thorough understanding of the effects of relaxation on the biochemical processes of depression, anxiety and pain is to date inconclusive.

Synthesis of outcome results

Combining the original analysis which found all active treatment groups to be effective in comparison to the psychoeducational group, with the reanalysis which found relaxation to be the most effective of the three

interventions, it is plausible that some form of relaxation is the most effective and final common pathway to CLBP management. This is suggested because even though the active treatments differed procedurally in presentation and practice by the contrast design, the presence or absence of imagery was of no significant effect except in comparison to the psychoeducational group. In the critical reanalysis relaxation was found to be superior suggesting that a by-product of imagery, being a relaxation response, may have accounted for the effectiveness of imagery as part of the total active intervention versus passive intervention contrast analysis. It appears that in the current study, progressive muscle relaxation is the most efficacious intervention for this male compensation CLBP population.

With respect to the efficacy of relaxation, these findings are consistent with other studies involving the chronic back pain population (e.g., McCauley, Frank & Callen, 1983; Turner, 1982). Furthermore this author shares the opinion of the above cited authors that the ease of administration, its simplicity, its applicability to group intervention, its flexibility for regimented treatment settings, and its transferability (from the treatment setting to home or work) make group progressive muscle relaxation procedures an effective and cost-effective intervention for service delivery to a CLBP population. This does not necessarily preclude the use of imagery procedures as viable alternatives to progressive muscle relaxation

procedures. However within the time frame of the current study the presence or absence of imagery had no special effect. This finding may be explained by results found in a study (Raft, Smith & Warren, 1986) which indicated that for acute pain imagery proved a potent coping mechanism, but that the effects of imagery with a chronic pain population were equally successful initially and then became less effective within a short period of time. Clearly, an implication for future research is that variations in imagery techniques should be examined in relation to the CLBP population.

Inherent weaknesses and potential limitations

A number of limitations must be recognized in the interpretation of this investigation. One potential limitation was the use of a single therapist of relatively limited clinical experience in using relaxation and/or imagery with the chronic pain population (3 years). Although using a single therapist alleviated the problem of therapist differences, it is possible that a therapist by treatment interaction could have occurred and could have been responsible for the pattern of results. In spite of efforts to standardize procedures via external review and strict adherence to protocols, this remains a potential limitation. However, the author does not question the efficacy of the treatments because all were apparently successful. Rather, the issue is whether one of the active treatments, with

control for therapist effects, may have achieved greater reduction in the dependent measures.

Instrumentation limitations to the current study included a heavy reliance upon self-reports, such as the subjective pain monitoring. With respect to subjective pain monitoring, it is possible that the act of self-monitoring may exert interactive effects on pain measurement suggesting that future study should utilize external methods of pain measurement. Given the complexity of the institution where the research was conducted, external observer ratings proved too costly from a personal resource perspective. It is also important to note that subjects in this study were not formally diagnosed as being depressed according to the DSM-III (Diagnostic and Statisitical Manual of Mental Disorders, 3rd Edition: American Psychiatric Association, 1980), or the Research Diagnostic Criteria (Spitzer, Endicott & Robins, 1978). However the lack of formal diagnosis was a subject limitation, that is, it precluded knowing the duration of a patient's depressive episodes (if they existed) as well as identifying possible concurrent psychopathology. A number of studies however cite the use of certain self-report measures of depression, for example, as equal in sensitivity and specificity to detect depression as concurrently determined by various psychiatric interview schedules (France, Houpt, Skott, Krishnan & Varia, 1986; Love, 1987; Turner & Romano, 1984).

This current study utilized the Beck Depression Inventory (BDI). The study of depression in chronic pain patients may be confounded by the patient's medical condition (e.g., see Romano & Turner, 1985), and the BDI may actually be measuring certain somatic complaints that may result from a physical condition (e.g., prolapsed disc) regardless of the existence of a depressive disorder. Therefore questions evaluating indicants of depression such as sleep disturbance, decreased energy or inability to work may be frequently endorsed by patients with persistent pain. This may account for the no treatment significance on the measure of depression because the BDI related to states more indicative of chronic pain than depression. In a recent study (Steer, Beck, Riskind & Brown, 1987) looking at different symptom clusters of depression in an outpatient population diagnosed via the DSM-III, and as measured by the BDI in comparison to the Hamilton Psychiatric Rating Scale for Depression (HRSD), it was determined that the HRSD better addressed symptoms related to somatic complaints while the BDI loaded on more cognitive-affective aspects of depression. Further research may implement both instruments to tease out those depressive symptoms more likely to change as a result of treatment, and therefore address the inherent problem of using self-report measures to determine depression in a compensation population.

Other limitations include the use of a number of univariate analyses in the contrast design which produces an

alpha pyramiding effect. However multivariate analysis was used where more appropriate (subjective course evaluation and two month follow-up). The follow-up was adequate with respect to the number of responses returned, however, the questions were related to the dependent measures of study but were not the actual dependent measures therefore the determination of the sustaining effects of treatment is tentative. Since a majority of the participants lived out of the city from the rehabilitation centre, both ethical and financial concerns prohibited the dependent measures to be mailed and returned, or to have the participants return to the city for the follow-up. Lastly, research was conducted on male chronic low back pain population and hence the results can be generalized to that population only. At the rehabilitation centre, approximately 90% of the CLBP patients are male thus this limitation is relatively minor.

Inherent strengths

The investigation presented meets many of the criteria described by Kazdin (1980) as dimensions by which clinical research evaluates clinical situations, therefore addresses the external validity of research. This current study will be evaluated along each dimension discussed by Kazdin and graded by the following rating system: great resemblance, moderate resemblance, and low resemblance. There are a total of nine dimensions.

1. **Target problem.** In order for clinical research to be graded high on this dimension the research must involve an intense, disabling problem typical of its clinical presentation. Clearly in the present study, the subject pool suffers from CLBP that is disabling enough to warrant compensation benefits. Grade = great.

2. **Population.** A great rating is warranted if the clients are typical of the outpatient population being the focus of concern. The current study not only meets this criteria but the research subject population in terms of clinical (e.g., depression) and demographic findings are similar to those reported by other authors in terms of limited education (e.g., France, et al., 1986), ineffective surgical intervention (Sternbach, Wolf, Murphy & Akeson, 1974), and a tendency to be older (e.g., Love, 1987). Grade = great.

3. **Manner of recruitment.** To justify a great resemblance rating clients must on their own volition seek treatment. In this study because the research participants were randomly selected from a treatment population a high rating is not warranted. Grade = moderate.

4. **Therapist.** Great resemblance requires that a professional therapist be used. The therapist was a doctoral student in training. Grade = moderate.

5. **Client set.** A great resemblance rating is applied to situations in which clients expect treatment and improvement as opposed to experimental procedures with unclear effects.

As the research participants were presented with a treatment and accompanying rationale for effective outcome, the implied intention of all four groups was some level of improvement. However the CLBP group may be a resistant or skeptical group to psychological procedures being used for apparent physical dysfunction. Grade = moderate.

6. **Selection of treatment.** In order to receive a high grade clients are to choose the therapist and subsequent treatment. As a function of the study, subjects were randomly assigned to groups, and groups to treatments. There was no therapist option. Grade = low.

7. **Setting of treatment.** The research was conducted within a professional treatment facility. Grade = great.

8. **Variations in treatment.** For research purposes standardized treatment procedures and protocols were used hence less flexible than would otherwise be the case. Grade = moderate.

9. **Assessment methods.** Great resemblance is warranted by the use of direct, unobtrusive measures of the problem that the client initially reports. In the present study the assessment procedure has been accomplished by use of standardized psychological instruments and questionnaire responses. Grade = moderate to low range.

Overall using Kazdin's grading system to study the applicability of clinical research, that is to resemble the reality of psychological intervention in actual clinical situations, the author is confident that to a moderate

degree the structure and procedures utilized in the current research are representative of the clinical situation. Hence research evidence or findings may readily streamline into practise, and be used to promote continued applied research.

With respect to the internal validity of the study a number of controlling factors operated to minimize extraneous sources of variance. At a less formal level with respect to questions of treatment effectiveness, the lack of prior medical treatment, together with a longstanding problem of CLBP, both act as controls for evidenced improvement. At a more formal level, the experimental design (experimental groups-control group: randomized subjects) acts as a vigorous control for threats to the internal validity of this study (e.g., pretesting procedures, statistical regression, etc.). Further to this, because all groups were compiled by random assignment procedures, and therefore experienced similar group dynamics (e.g., cohesion or competition), and that the expectancy scores were not found to be associated with improvement, the likelihood of demand or expectancy interpretations are weakened, hence the results cannot be attributed solely to placebo or nonspecific factors. The opportunity to randomly assign research participants in an applied treatment facility is not only a rare occurence, but is a very powerful control and should be accomplished wherever possible in a study designed to address questions of scientific relevance (Kerlinger, 1973).

Other factors that pertain to all four treatment groups may have had a chance to operate as an obstacle to any form of effective psychological intervention. Often compensation or 'litigation-pending' subjects are excluded from treatment outcome studies; the fear of the pain-for-pay phenomenon. It is assumed that many of the so called 'functional' CLBP patients are lazy, unmotivated hence not suitable for research purposes. The current study confronts both of these "liabilities" in the research. The compensation CLBP population presents as a most challenging population for health care professionals, yet little research has been conducted on treatments adjunct to those of medical orientation. In spite of the stereotypical liabilities identified in the compensation population that often prevents research on this group of chronic pain patients, positive results were found. Although the gains made were not of dramatic dimension, the results are promising. Further research is required, as appropriate CLBP management may lead patients to return back to employment. Present studies evaluating the rate of return to work for the compensation chronic pain population estimate that there is only a 20% chance of returning to work after 1 year off work, and a 10% chance after 2 years of work (McGill, 1968). Merely the economics of the situation alone warrants further research that may facilitate CLBP management and hence optimize potential return to employment. Based upon this study, it appears that work disabled CLBP compensation

patients benefitted from a brief, intense group intervention that showed relaxation and imagery to be effective in comparison to those who did not receive active treatment.

Future research directions

Although no active treatment differences were found in the contrast design, it is plausible that random assignment procedures may hide true differences between the active treatment interventions. That is in comparing the average responses (outcome measures) of any two groups at a time (e.g., no imagery to imagery) with more or less equivalent patients, it may be the case that the same "kinds" of patients respond either to imagery or no imagery. This would produce equivalent results if group comparisons were made. Alternatively, it may also be the case that different kinds of patients respond to one form of treatment while others respond to another form of treatment. With equal percentages of certain kinds of patients in 3 randomly formed groups, one may also find equivalent results. Hence further research at the subject level should be directed toward identifying characteristics unique to patients who respond favourably to one or the other of the active treatment formats.

Previous research has implicated the role of coping styles or strategies used by people who suffer from chronic pain (e.g., Brown & Nicasso, 1987; Tan, 1982), and specifically CLBP (e.g., Rosenstiel & Keefe, 1983; Turner & Clancy, 1986). In the Brown & Nicasso (1987) study, active

coping styles as opposed to passive coping styles were associated with reports of less pain, depression, functional impairment and higher general self-efficacy. The implications of research on coping style have direct relevance to choosing an appropriate psychological intervention for people exhibiting a specific personal coping response. For example, would a less structured imagery exercise be more effective for an individual who exhibited a passive or active coping style? Health beliefs (e.g., Roberts, Smith, Bennett, Cape, Norton & Kilburn, 1984) also impact upon adjustment and subsequent health intervention and maintenance of health modified behaviour. Again research in this area may be profitable in an attempt to optimize treatment effectiveness by matching on potent factors.

At the treatment intervention level, further research is required to determine what treatment components enhance treatment effectiveness. For example, the current study compared "brands" of relaxation and imagery to each other. "Within brand" comparisons are also warranted, for example, comparing guided imagery to self-structured imagery. Comparing progressive muscle relaxation to suggestions of muscle relaxation may also prove as another example of potential future research. These intervention variables then can be linked to variables measured at the subject level. For example, in one study (Richard, Crist & Barder, 1985) examining the influence of suggestibility on variations of

relaxation, it was found that highly suggestible subjects performed better regardless of the variation in relaxation training mode (progressive relaxation vs. suggestions of relaxation). It was also found that progressive relaxation yielded higher relaxation scores than suggestions of relaxation. Further it was found that subjects who scored low on suggestibility reported relaxing better only under the training mode of progressive relaxation. A very similar study could be implemented with the compensation CLBP population using pain as one of the dependent measures to further scrutinize individual variables that operate to interact with treatment intervention.

Research into health interventions has also demonstrated that choice can significantly reduce discomfort and dissonance the individual feels, therefore leads to appraising treatment outcomes as more favourable (Taylor, 1986). For example, being given an experiential trial of each of the active interventions, and then given a choice as to which of the interventions an individual perceives will provide the most benefit for effort may have an effect on differential rates of specific treatment effectiveness. The role of information material as it impacts upon control-based psychological intervention requires further analysis. In a study of experimentally induced acute pain, subjects were given varied information as to the effectiveness of the accompanying music to help attenuate the discomfort (Melzack, Weisz & Sprague, 1963). All

subjects were told that they could control the level of music piped into the room. Only the group that had received information as to the benefits of music in relation to discomfort increased their tolerance for pain. Hence, variations in information may have an interactive effect on the ability of psychological intervention to ameliorate conditions associated with chronic pain.

Levels of social support have also been implicated as an important factor in the health of individuals. People with high levels of social support have been found to have lower rates of psychological distress (e.g., Billings & Moss, 1982), may require less medication (Taylor, 1986), may recover from illness faster than people with low levels of social support (Cobb, 1976), and are more inclined toward health services hence are more compliant with medical regimens (Wallston & Wallston, 1983, cited in Taylor, 1986). Many participants of the research study (including those from the psychoeducational group) commented that they wished their wife or friend were with them during the lectures and exercises so that some of the complications of CLBP could be understood by significant others. Future research may be directed at incorporating a family member or some support agent during the intervention process. This may help to reduce the stress experienced at home because of the many burdens incurred as a result of a compensation claim, plus it may also serve to reinforce and maintain those skills learned during the program, hence facilitate transmission to

the home environment.

Lastly, the chronic pain-depression link can be aptly described as a controversial one. However other psychological factors are now being identified in an attempt to sort out the relationship between chronic pain and depression. Anhedonia, a lowered ability to experience pleasure, was found to be correlated with depression in chronic facial pain patients (Marbach & Lund, 1981). Chronic pain patients have also been described as alexithymic (Taylor, 1984), the limited existence of fantasy and emotion, and highly defensive and somatically focussed (Kremer, Atkinson & Kremer, 1983). As a result future research should focus on more emotion-based interventions for chronic pain. Hence emotive/experiential orientations may comprise a major component to an effective pain management program. Perhaps the current study's failure in reducing scores on the depression dependent measure was because it was not emotive enough in orientation.

Final comments

The development of psychological interventions specifically for physical well-being presents as a departure from the historical focus of psychology, that being mental well-being. Partially this reflects a shift in health care orientation from a strict biomedical model to an integrative one. Contributing to this trend has been the development of a health-oriented subspecialty within the discipline of

psychology. By various research efforts, dimensions previously considered only to be worthy of study within the realm of psychology were becoming recognized as being valuable and having impact upon health care, including prevention and treatment of illness, health promotion and maintenance, the identification of etiologic and diagnostic correlates of health, illness and dysfunction and improvement in the health care system and the formulation of health policy (Matarazzo, 1980). For example, a variable previously linked to the soft science of psychology, such as the notion of "control", has gained credibility in the hard scientific world of health care and is having a direct impact upon patient-doctor relationships, maintaining health care regimens and in devising optimal medical programs with the benefit of psychological research.

In response to being accepted as a worthy health care provider, the discipline of psychology should adjust accordingly. For example, great effort will be expended in educating the public about psychology's input and value in the health care system. Psychology will have to overcome its reputation as a provider to those who suffer specifically from mental or emotional problems. The delivery of psychological intervention will be a group approach rather than the stereotypic one-to-one format. The change in this service delivery format will be cost containing for those who must endure the economic burden (third party payers, actual patients), and cost-effective for employers of health

care providers who must operate within a limited budget therefore must maximize the use of personnel effectively.

A challenge that remains for psychologists in the health care industry is that in order to prove viability in the brutish economic reality of spending cuts and budget bashing, future research must be more applicable to actual practice and scientifically prove the benefits of psychological intervention as adjunct to traditional medical approaches. Psychology cannot prosper in the health care industry without acknowledging the consumerism of its product. Research will become more oriented toward the long-term cost-effectiveness of various psychological interventions. Previous criticisms of modern clinical/counselling research came not from ivory tower philosophers, but the practising clinicians. Many psychologists have been dismayed with the failure of the integration of practise and research (Barlow, 1981). The inapplicability of research findings to clinical practise has been so blatant that Matarazzo (cited in Bergin & Strupp, 1972) stated that "[e]ven after 15 years few of my research findings affect my practise. Psychological science per se, doesn't guide me one bit ..."(p. 340). It is in partial response to these comments that this study aspires. The intent of this study was to determine the efficacy of three modalities (relaxation, imagery and mixed) of psychological treatment on the male compensation chronic low back pain population. It is hoped that this study may

stimulate further research in the area of the compensation chronic pain population.

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APPENDICES

APPENDIX PAGES 180 to 204 HAVE BEEN
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